THE SCHOOL DISTRICT OF PHILADELPHIA Office of Capital Programs 440 North Broad Street, 3^{rd.} Floor – Suite 371 Philadelphia, PA 19130

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ADDENDUM No. 01

Subject:

North East High School – AC Upgrade Project SDP Contract No. B-006c & 007c 2020/21

Location: North East High School 1601 Cottman Avenue Philadelphia PA 19111

This ADDENDUM dated May 13, 2021 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.

1.REVISIONS TO TECHNICAL SSPECIFICATIONS AND DRAWINGS:

DELETE the Original Issue Technical Specifications (Project Manual), dated 07 MAY 2021, and 100% Design Submission Drawings, dated April 30, 2021;

REPLACE with the attached Technical Specifications (Project Manual) dated 12MAY2021 and Issued for Bid Drawings for Bid, dated MAY 12, 2021.

2. BIDDER QUESTIONS

1. The AC units #023, 024, 033, 034 and 035 are listed on the schedule, but not shown as being replaced on the drawings. Are we to replace these (5) units?

RESPONSE: Yes. Refer to M101 keynote #1. Provide new Window Air Conditioning Units inclusive of ACU-023, 024, 033, and 034. Refer to M101 keynote #5. Provide new PTACs inclusive of PTAC-035.

ATTACHMENTS:

Technical Specifications (Project Manual) dated 12MAY21, 92 pages

Issued for Bid drawings, dated May 12, 2021, 18 pages



FOR



BY





ENGINEER'S PROJECT NO. 068625 SCHOOL DISTRICT PROJECT NO. B-006(c) of 2020/2021 and B-007(c) of 2020/2021

12 MAY 2021

SECTION 02 4119

SELECTIVE ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of material for demolition and salvaging existing electrical systems, wiring, raceways, supports, equipment, and minor repair of underlying structure.
- B. Related Sections:
 - 1. Division 01 General Requirements

1.02 REFERENCES

A. National Fire Protection Association (NFPA):
 1. NFPA 70 - National Electrical Code (NEC)

1.03 SUBMITTALS

A. Submit demolition plan.

1.04 COORDINATION AND SEQUENCING

- A. Coordinate all power outages with Owner.
- B. Perform demolition in a manner not to delay or interfere with other operations of work in the Project and operations of the Owner.

1.05 SCHEDULING

- A. Schedule all work with the Owner through the Owner's designated representative. Start no work in an area until a schedule has been prepared, submitted, and approved.
- B. Coordinate the work schedule with the Owner, Engineer, and other Contractors. Coordinate the work so not to interfere or conflict with the performance of work by the Owner and the Owner's tenants.

1.06 PROJECT/SITE CONDITIONS

- A. Care shall be used so as not to impede the ongoing operations of the Owner.
- B. Demolition work, as specified herein, is not intended to be performed as a wrecking operation but as work relative to the performance of the various construction operations of the Project.
- C. Existing Conditions:
 - 1. Demolition information shown or otherwise indicated on the Drawings is based on visual field examination and existing record documents. While the information provided is believed to be correct, no assurance is implied relative to its total completeness or accuracy. Report discrepancies to Construction Manager for disposition of the Engineer before disturbing existing installations.

- 2. The Contractor hereby distinctly agrees that neither the Construction Manager, the Engineer nor the Owner is responsible for the correctness or sufficiency of the information given and after his own Site Investigation:
 - a. That he must have no claim for delay or extra compensation or damage on account of the information given; and
 - b. That he must have no claim for relief from any obligation or responsibility under the Contract with respect to the above stated stipulations.
- D. Protection: Exercise care during demolition work to confine demolition operations to the areas as indicated on the Drawings. The physical means and methods used for protection are at the Contractor's option. However, the Contractor will be completely responsible for replacement and restitution work, of whatever nature, at no expense to the Owner.
 - 1. Additionally, if public safety is endangered during the progress of the demolition work, provide adequate protective measures to protect the public and/or Owner personnel.
 - 2. Conform signs, signals and barricades to requirements of Federal, State and local laws, rules, regulations, precautions, orders and decrees.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Basic Electrical Materials: Those products such as conduit, raceway, wire and cable, support devices, fasteners, and control devices as required for work of this Section are specified in other Sections.
- B. Equipment along with machinery and apparatus, motorized or otherwise, used to perform the demolition may be chosen at the Contractor's discretion. However, the chosen equipment shall perform the work within the limits of the Contract requirements.
- C. Patching Materials: Patching materials shall match, as nearly as practical, the existing material for each surface being patched.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify that measurements and existing circuiting arrangements are as shown on Drawings.
- B. Equipment, machinery, and apparatus, motorized or otherwise, used to perform the demolition work may be used as chosen at the Contractor's discretion, but which will perform the work within the limits of the Contract requirements.
- C. Verify that abandoned wiring and electrical equipment serve only the abandoned facility.

3.02 DEMOLITION

- A. General: The means and methods of performing electrical demolition and removal operations are the sole responsibility of the Contractor, except as otherwise specified. However, equipment used, and methods of demolition and removal will be subject to approval of the Construction Manager and the Engineer.
 - 1. Remove, relocate, and extend existing installations to accommodate new construction as indicated and/or as required.

- 2. Remove exposed abandoned conduit systems, including abandoned conduit systems above accessible ceiling systems.
- 3. Remove wiring in abandoned conduit systems to source of power supply.
- 4. Maintain access to existing electrical installations, which remain active. Modify installations and provide access panels or plates as appropriate.
- 5. Extend existing installations using materials and methods compatible with existing electrical installations, and as specified in other Sections of these Specifications.
- 6. Wiring Devices:
 - a. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduits serving them is abandoned and removed. Provide blank covers for abandoned outlets, which are not removed.
 - b. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- 7. Lighting:
 - a. Disconnect and remove lighting fixtures as indicated on the Drawings. Remove associated brackets, stems, hangers and other accessories. Remove abandoned lighting outlets and associated conduit and wire if not reused for new lighting equipment.
- 8. Equipment:
 - a. Disconnect and remove electrical equipment where so indicated on the Drawings.
 - b. Disconnect and remove abandoned distribution equipment, panelboards, disconnect switches and motor starters as indicated on the drawings or as otherwise required due to the removal of associated equipment.
- 9. In exposed, through-structure conduit locations, the abandoned conduit(s) must be cut below the finished structural surface in order to perform surface patching.
- B. System De-activation: Prior to demolition and removal work, de-activate existing electrical systems as indicated.
- C. Use means and methods for permanent disconnection, which render the remaining electrical systems and apparatus in conformity with NFPA 70.
- D. Provide temporary wiring and connections as required to maintain existing systems in service during construction. Remove same when no longer required.
 - 1. Conform temporary wiring to the requirements of NEC Article 305, General Requirements.
- E. Remove all wiring from disconnected circuits, feeders, and equipment unless otherwise specified or indicated. Remove all exposed raceways and related supports. Cut all exposed raceways flush with floor and plug.
- F. Coordinate electrical power outages with requirements in Section 26 0500.
- G. General: The means and methods of performing electrical demolition and removal operations are the sole responsibility of the Contractor except as otherwise specified. Use equipment and methods that do not damage items to remain or salvaged and areas adjacent to demolition operations. Use methods that do not interfere with Owner's operations and which do not cause excessive dust. Remove debris as it accumulates.
- H. Cutting: Perform cutting work of existing structure materials by such methods as will prevent extensive damage beyond the immediate area of cutting.
- I. Debris Removal: Dispose of demolition debris off site in a lawful manner. Containerize or otherwise store debris as work is in progress.

- J. Patching: After demolition and removal work is performed patch the existing structure as required to match surrounding finish and appearance including the appropriate surface decoration.
- K. Abandoned Electrical Equipment and Apparatus: Existing electrical equipment and apparatus in or on the structures not claimed as salvage by the Owner shall become the property of the Contractor and may not be disposed of on the site but removed and disposed of in a lawful manner off-site.
- L. Salvage: The Owner shall have the right to claim as salvage any items and materials removed under the work of this Section. Should such right of salvage be exercised by the Owner, move and neatly store removed items on the site in a location agreeable to the Owner and in a manner approved by the Engineer.

END OF SECTION 02 4119

SECTION 09 6500 RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

1.02 REFERENCE STANDARDS

- A. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- B. ASTM F970 Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
- C. ASTM F1066 Standard Specification for Vinyl Composition Floor Tile.
- D. ASTM F1861 Standard Specification for Resilient Wall Base.
- E. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- F. ASTM F2169 Standard Specification for Resilient Stair Treads.
- G. RFCI (RWP) Recommended Work Practices for Removal of Resilient Floor Coverings.

1.03 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Flooring Material: 50 square feet of each type and color.
 - 2. Extra Wall Base: 50 linear feet of each type and color.
 - 3. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.06 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

Resilient Flooring 09 6500 Page 1 of 3

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
 - 1. Manufacturers:
 - a. Armstrong Flooring, Inc; Standard Execelon Imperial Texture: www.armstrongflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - c. Or approved equal.
 - 2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
 - 3. Size: 12 by 12 inch.
 - 4. Thickness: 0.125 inch.
 - 5. Color: To be selected by Architect from manufacturer's full range.

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TV, vinyl, thermoplastic; top set Style B, Cove.
 - 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - b. Roppe Corp: www.roppe.com/#sle.
 - c. Or approved equal.
 - 2. Height: 4 inch.
 - 3. Thickness: 0.125 inch.
 - 4. Finish: Satin.
 - 5. Color: To be selected by Architect from manufacturer's full range.
 - 6. Accessories: Premolded external corners and internal corners.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: Same material as flooring.
- D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.

- C. Adhesive-Applied Installation:
 - 1. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 0526 for grounding and bonding to building grounding system.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Resilient Strips: Attach to substrate using adhesive.
- F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- G. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 23 0553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Pipe markers.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 Scheme for the Identification of Piping Systems.
- B. ASTM D709 Standard Specification for Laminated Thermosetting Materials.

1.03 SUBMITTALS

- A. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Instrumentation: Tags.
- B. Piping: Tags.
- C. Small-sized Equipment: Tags.
- D. Thermostats: Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 4. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
- B. Letter Color: White.
- C. Letter Height: 1/4 inch.
- D. Background Color: Black.
- E. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers:
 - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
 - 2. Brady Corporation: www.bradycorp.com/#sle.
 - 3. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com/#sle.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.

Identification for HVAC Piping and Equipment

- 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
- 4. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Color: Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- E. Color code as follows:

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- G. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 7416.11 PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes packaged, small-capacity, rooftop air handlung units (RTUs) with the following components and accessories:
 - 1. Casings.
 - 2. Fans.
 - 3. Motors.
 - 4. Coils.
 - 5. Refrigerant circuit components.
 - 6. Air filtration.
 - 7. Dampers.
 - 8. Electrical power connections.
 - 9. Controls.
 - 10. Accessories.

1.02 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Include diagrams for power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Seismic Qualification Data: Certificates, for Air Handling Units, accessories, and components, from manufacturer.
- C. Field quality-control reports.
- D. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in materials or workmanship within specified warranty period.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Trane
- B. Carrier
- C. Johnson Controls

2.02 DESCRIPTION

- A. AHRI Compliance:
 - 1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.
- B. AMCA Compliance:
 - 1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
 - 2. Damper leakage tested according to AMCA 500-D.
 - 3. Operating Limits: Classify according to AMCA 99.

- C. ASHRAE Compliance:
 - 1. Comply with ASHRAE 15 for refrigeration system safety.
 - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 - 3. Comply with applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
- D. ASHRAE/IES Compliance: Comply with applicable requirements in ASHRAE/IES 90.1, Section 6 "Heating, Ventilating, and Air-Conditioning."
- E. NFPA Compliance: Comply with NFPA 90A.
- F. UL Compliance: Comply with UL 1995.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.03 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: RTUs, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."

2.04 CAPACITIES AND CHARACTERISTICS

- A. Exterior Casing Thickness: 0.052 inch thick.
- B. Supply-Air Fan: refer to drawings
- C. Supply-Air Refrigerant Coil: refer to drawings
- D. Electric-Resistance Heating Coil: refer to drawings
- E. Compressors:
 - 1. Number of Refrigerant Circuits: One.
 - 2. Compressor Speed: Variable.
- F. Dampers:
 - 1. Outdoor-Air Damper: Linked damper blades, for zero to 100 percent outdoor air, with motorized damper.
- G. Outdoor-Air Filters: refer to drawings
- H. RTU Electrical Characteristics for Single-Point Connection: refer to drawings. Furnish with factory fused disconnect switch (capable of lock-out/tag-out) in NEMA 3R enclosure. Provide with minimum short circuit current rating of 65,000 Amps.

2.05 CASINGS

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Double-Wall Construction: Fill space between walls with 1-inch foam insulation and seal moisture tight for R-7 performance.
- C. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
- D. Inner Casing Fabrication Requirements:
 - 1. Inside Casing: G-90-coated galvanized steel, 0.034 inch thick.
- E. Condensate Drain Pans: Fabricated using G-90-coated galvanized-steel sheet 0.028 inch thick, a minimum of 2 inches deep, and complying with ASHRAE 62.1 for design and construction of drain pans.
 - 1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 - 2. Drain Connections: Threaded nipple.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.06 FANS

- A. Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
 - 1. Direct-Driven Supply-Air Fans: Motor shall be resiliently mounted in the fan inlet.
 - 2. Belt-Driven Supply-Air Fans: Motors shall be installed on an adjustable fan base resiliently mounted in the casing.
- B. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECM motors.

2.07 MOTORS

- A. Comply with Section 230513 "Common Motor Requirements for HVAC Equipment" and the requirements of this Article.
- B. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- C. Service Factor: 1.15.
- D. Efficiency: Premium efficient.

2.08 COILS

- A. Supply-Air Refrigerant Coil:
 - Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical 1. distributor.
 - Polymer strip shall prevent all copper coils from contacting steel coil frame or condensate 2. pan.
 - 3. Coil Split: Interlaced.
 - Coated. 4.
- B. **Electric-Resistance Heating:**
 - Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
 - 2. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
 - 3. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
 - Control Panel: Unit mounted with disconnecting means and overcurrent protection. 4 Include the following controls:
 - SCR Controller: Pilot lights operate on load ratio, a minimum of five steps. a.
 - b. Time-delay relay.
 - c. Airflow proving switch.

2.09 REFRIGERANT CIRCUIT COMPONENTS

- A. Compressor: Hermetic, variable-speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.
- **Refrigeration Specialties:** Β.
 - Refrigerant: R-410A. 1.
 - Expansion valve with replaceable thermostatic element. 2.
 - Refrigerant filter/dryer. 3.
 - 4. Manual-reset high-pressure safety switch.
 - 5. Automatic-reset low-pressure safety switch.
 - Minimum off-time relay. 6.
 - 7. Automatic-reset compressor motor thermal overload.

Packaged, Small-Capacity, Rooftop Air-Conditioning Units

8. Brass service valves installed in compressor suction and liquid lines.

2.10 AIR FILTRATION

A. Minimum MERV 13 rating according to ASHRAE 52.2.

2.11 DAMPERS

- A. Leakage Rate: Comply with ASHRAE/IES 90.1.
- B. Damper Motor: Modulating with adjustable minimum position.

2.12 ELECTRICAL POWER CONNECTIONS

A. Alr Handling Unit shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.13 CONTROLS

- A. Basic Unit Controls:
 - 1. Control-voltage transformer.
- B. Electronic Controller:
 - 1. Controller shall have volatile-memory backup.
 - 2. Implement sequence of operation shown on the drawings for the makeup air unit/exhaust fan/ hood controls.
 - 3. Supply Fan Operation:
 - a. Run fan continuously when hood is commanded on.
 - b. Vary fan speed for constant airflow regardless of filter loading
 - 4. Refrigerant Circuit Operation:
 - a. Occupied Periods: modulate compressor to match compressor output to cooling load to maintain discharge temperature. Cycle condenser fans to maintain maximum hot-gas pressure.
 - b. Unoccupied Periods: Compressors off.
 - 5. Electric-Heating-Coil Operation:
 - a. Occupied Periods: Modulate coil to maintain discharge temperature.
 - b. Unoccupied Periods: Energize coil to maintain setback temperature.

2.14 ACCESSORIES

- A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer. Outlet shall be energized even if the unit main disconnect is open.
- B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- C. Safeties:
 - 1. Condensate overflow switch.
 - 2. Phase-lossprotection.
 - 3. High pressure control.
 - 4. Electric coil airflow-proving switch.
- D. Coil guards of painted, galvanized-steel wire.
- E. Door switches to disable heating or reset set point when open.
- F. Outdoor-air intake weather hood with moisture eliminator.
- G. Oil separator.

PART 3 EXECUTION

3.01 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction.

3.02 CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 - 4. Install normal-weight, 3000-psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified with concrete.
- B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- C. Connect electrical wiring according to division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- D. Ground equipment according to division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Install nameplate for each electrical connection indicating electrical equipment designation and circuit number feeding connection.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. RTU will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.04 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and airdistribution systems, clean filter housings and install new filters.

3.05 **DEMONSTRATION**

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

END OF SECTION 237416.11

SECTION 23 8113 PACKAGED TERMINAL AIR-CONDITIONERS

<<<< UPDATE NOTES

PART 1 GENERAL

2.01 SECTION INCLUDES

- A. Air conditioning units.
- B. Cabinet.
- C. Evaporator fan.
- D. Compressor.
- E. Evaporator coil.
- F. Condenser.
- G. Air filters.
- H. Controls.

2.02 SUBMITTALS

- A. Product Data: Provide data for manufactured products and assemblies. Indicate water, drain, thermostatic valves, and electrical rough-in connections with electrical characteristics and connection requirements.
- B. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
- C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Filters: One set for each unit.
 - 2. Extra Fan Belts: One set for each unit.

2.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.04 WARRANTY

A. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

3.01 MANUFACTURERS

- A. Amana Heating and Air Conditioning; PTC or PTH: www.amana-ptac.com/#sle.
- B. Friedrich Air Conditioning Co; SG Series: www.friedrich.com/#sle.
- C. Trane Inc; ProSpace PTAC: www.trane.com/#sle.

3.02 AIR CONDITIONING UNITS

- A. Description: Packaged, self-contained, factory assembled, prewired unit, consisting of cabinet, compressor, condensing coil, evaporator fan, evaporator coil, discharge plenum, outside air connection, heating coil, air filters, and controls; fully charged with refrigerant and filled with oil.
- B. Assembly: Up flow air delivery, in draw-through configuration as indicated.
- C. Refrigerant: Use only refrigerants that are compliant with the United States Environmental Protection Agency Refrigerant Phaseout Plan relative to Section 605 of the Clean Air Act and Packaged Terminal Air-Conditioners

have an ozone depletion potential (ODP) of zero as well as global warming potential (GWP) of less than 2500.

- D. Energy Efficiency:
 - 1. Cooling Capacity: Less than 65,000 Btu/h:
 - a. Energy Efficiency Rating (EER): 12.1 Minimum
- E. Electrical Characteristics:
 - 1. Disconnect Switch:
 - a. Factory mount in control panel.

3.03 CABINET

- A. Cabinet: Wall mounted of 16 gage galvanized steel with epoxy coated finish, removable from panel, concealed lat
- B. Frame and Panels: Galvanized steel with baked enamel finish, easily removed access doors or panels with quick fasteners.
- C. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.
- D. Drain Pan: Galvanized steel with corrosion-resistant coating.

3.04 EVAPORATOR FAN

- A. Fan: V-Belt driven, with permanently lubricated bearings, double width, double inlet, forward curved centrifugal fan, statically and dynamically balanced, resiliently mounted.
- B. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

3.05 COMPRESSOR

A. Hermetically sealed, 3600 rpm maximum, resiliently mounted with positive lubrication and internal motor protection.

3.06 EVAPORATOR COIL

- A. Direct expansion coiling coil of seamless copper or aluminum tubes expanded into aluminum fins.
- B. Refrigeration circuit with externally equalized thermal expansion valve, filter-drier, and charging valves.

3.07 CONDENSER

- A. Co-Axial: Copper tube in copper tube or shell and tube with finned copper tubes in steel shell with water temperature actuated water regulating valve.
- B. Terminate suction and liquid refrigerant piping with service valves within unit.
- C. Fan: Double width, double inlet, forward curved centrifugal fan, statically and dynamically balanced, with permanently lubricated bearings.
- D. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

3.08 AIR FILTERS

A. Easily removed 2 inch thick disposable glass fiber panel filters.

3.09 CONTROLS

- A. Factory wired controls shall include contactor, high and low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, non-cycling reset relay.
- B. Provide thermostat to cycle cooling, mounted within unit with 'fan-off-cool' switch allowing continuous fan operation, or cycling fan on call for cooling.

C. Low Ambient Lockout Control: Below 35 degrees F, outdoor thermostat shall prevent compressor operation and switch to heat mode.

3.10 ACCESSORIES

- A. Wall Sleeve: Insulated Galvanized steel
- B. Outdoor Grille: Stamped, anodized aluminum.
- C. Disconnect Switch
- D. Condensate Drain Kit

PART 3 EXECUTION

4.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with requirements of NFPA 90A.
- C. Provide shut-off valves in condenser water inlet and outlet piping.
- D. Pipe condensate from drain pan to nearest floor drain.

END OF SECTION

SECTION 23 8119 SELF-CONTAINED AIR-CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Window air conditioning units.

1.02 SUBMITTALS

- A. Product Data: Provide drawings indicating dimensions, rough-in connections, and electrical characteristics and connection requirements.
- B. Manufacturer's Instructions: Include assembly instructions, support details, connection requirements, and start-up instructions.
- C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- D. Operation and Maintenance Data: Provide maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.
- E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.1. Extra Filters: One set for each unit.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.

1.05 WARRANTY

A. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Friedrich Air Conditioning Co[<>]: www.friedrich.com/#sle.
- B. Amana Heating and Air Conditioning: www.amana-ptac.com/#sle.
- C. Frigidaire: https://www.frigidaire.com/#sle.
- D. Sea Breeze: https://www.uri.com/#sle.

2.02 AIR CONDITIONING UNITS

- A. Description: Packaged, self-contained, through-the-wall air cooled terminal air conditioning units, with window mounting assembly, room cabinet, electric refrigeration system, built-in temperature controls; fully charged with refrigerant and filled with oil.
- B. Refrigerant: Use only refrigerants that are compliant with the United States Environmental Protection Agency Refrigerant Phaseout Plan relative to Section 605 of the Clean Air Act and have an ozone depletion potential (ODP) of zero as well as global warming potential (GWP) of less than 2500.
- C. Electrical Characteristics:
- D. Energy Efficiency:
 - 1. Cooling Capacity: Less than 65,000 Btu/h:
 - a. Energy Efficiency Rating (EER): 12.1 Minimum

Self-Contained Air-Conditioners 23 8119 Page 1 of 2

2.03 CABINET

- A. Cabinet: Wall mounted of 18 gage, 0.0478 inch galvanized steel with epoxy coated finish, removable front panel with concealed latches.
- B. Discharge Grille and Access Door: Removable punched louver discharge grilles, allowing 4way discharge air pattern with hinged door in top of cabinet for access to controls.

2.04 CONTROLS

- A. Control Module: Unit mounted adjustable thermostat with heat anticipator, off-heat-auto-cool switch, high-low fan switch.
- B. Low Ambient Lockout Control: Below 35 degrees F, outdoor thermostat shall prevent compressor operation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate installation of units with existing conditions and electrical work.

END OF SECTION

SECTION 23 8126.13 SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Split System Air Conditioning Units
- B. Indoor air handling (fan and coil) units for ductless systems.

1.02 SUBMITTALS

- A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- C. Design Data: Indicate refrigerant pipe sizing.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- H. Project Record Documents: Record actual locations of components and connections.
- Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 Extra Filters: One for each unit.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience and approved by manufacturer.

1.04 WARRANTY

- A. Provide five year manufacturers warranty for heat exchangers and compressors.
- B. Provide one year standard warranty on all other parts and labor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Mitsubishi: https://www.mitsubishicomfort.com/#sle
- B. Panasonic: https://na.panasonic.com/us/home-and-building-solutions/heating-airconditioning/#sle
- C. Bosch: https://www.bosch-thermotechnology.us/#sle

2.02 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factoryengineered and assembled, pre-wired indoor and outdoor units; UL listed.
 - 1. Heating: Natural gas fired.
 - 2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
 - 3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements:
 - 1. Efficiency:

a. Seasonal Energy Efficiency Ratio: 10.0, minimum.

2.03 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
 - 1. Location: High-wall.
 - 2. Cabinet: Galvanized steel.
 - a. Finish: White.
 - 3. Fan: Line-flow fan direct driven by a single motor.
 - 4. Filter return air with washable, antioxidant pre-filter and a pleated anti-allergy enzyme filter.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
 - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
 - 2. Manufacturer: System manufacturer.

2.04 OUTDOOR UNITS

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
 - 1. Comply with AHRI 210/240.
 - 2. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
 - 3. Refrigerant: R-410A.
 - 4. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
 - 5. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.
- B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.
- C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
 - 1. Condenser Fans: Direct-drive propeller type.
 - 2. Condenser Fan Motor: Enclosed, 1-phase type, permanently lubricated.
- D. Coil: Air-cooled, aluminum fins bonded to copper tubes.
- E. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
 - 1. Provide thermostatic expansion valves.
- F. Operating Controls:
 - 1. Control by room thermostat to maintain room temperature setting.
 - 2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that proper power supply is available and in correct location.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION

SECTION 23 8200 CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Unit ventilators.

1.02 REFERENCE STANDARDS

- A. AHRI Directory of Certified Product Performance Air-Conditioning, Heating, and Refrigeration Institute (AHRI).
- B. AHRI 350 Sound Performance Rating of Non-Ducted Indoor Air-Conditioning and Heat Pump Equipment.
- C. AHRI 840 Unit Ventilators.
- D. ASHRAE (HVACA) ASHRAE Handbook HVAC Applications.
- E. ASHRAE Std 62.1 Ventilation for Acceptable Indoor Air Quality.
- F. SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible.

1.03 SUBMITTALS

- A. Product Data: Provide typical catalog of information including arrangements.
- B. Shop Drawings:
 - 1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
 - 2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
 - 3. Submit the following for blower-coil units indicating:
 - a. Overall dimensions including installation, operation, and service clearances.
 - b. Lift points, recommendations, and center of gravity.
 - c. Unit shopping, installation, and operating weights including dimensions.
 - d. Fan curves with specified operating point clearly plotted.
 - e. Safety and start-up instructions.
- C. Manufacturer's Instructions: Indicate installation instructions and recommendations.
- D. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.05 WARRANTY

A. Provide 5 year manufacturer's warranty for compressors.

PART 2 PRODUCTS

2.01 UNIT VENTILATORS

- A. Acceptable Manufacturers:
 - 1. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.
 - 2. Johnson Controls
 - 3. Trane, a brand of Ingersoll Rand
 - 4. Substitutions: See Section 01 6000 Product Requirements.

- B. Performance Data and Safety Requirements:
 - 1. Unit capacities certified and tested in accordance with AHRI 840 and AHRI 350.
 - 2. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.
- C. Required Directory Listings: AHRI Directory of Certified Product Performance Air-Conditioning, Heating, and Refrigeration Institute (AHRI).
- D. Refrigerant Coils:
 - 1. Provide factory installed thermal expansion valves, properly sized to accommodate the selected condensing unit.
 - 2. Factory proof and leak tested to ensure leak tight operation.
 - 3. Provide insulated drain pan, to prevent condensation, with field convertible left or right hand connections.
- E. Steam Coils:
 - 1. Tube-in-tube, steam distributing coil design.
 - 2. Factory pressure tested to ensure leak tight design.
- F. Cabinet: 14 gage, 0.0747 inch sheet steel on solid base pan with exposed edges rounded. Provide removable front panels with quick-acting, key-operated cam locks. Provide removable die-cast or fabricated steel discharge grilles. For units having cooling coils, insulate internal parts and surfaces exposed to conditioned air stream with moisture resistant insulation.
- G. Cabinet Accessories: Matching steel construction, reinforced, for use with unit ventilators or finned radiation, with steel alignment pins, adjustable kick plates with leveling bolts, shelves and sliding doors with locks as indicated, sinks, bubbler faucets and bowls, corner, end, and wall filler sections as required.
- H. Finish: Factory applied baked primer coat on visible surfaces of enclosure or cabinet.
- I. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven, arranged to draw air through coil.
- J. Wall Louvers: Anodized aluminum wall intake box and louvers removable from frame with 1/2 inch square mesh galvanized screen in back of louver.
- K. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.
- L. Controls:
 - 1. Provide units with control valves furnished by the unit ventilator manufacturer.
 - 2. Unit Ventilator Manufacturer's Controls:
 - a. Fan speed switch for unit mounting.
 - b. Disconnect switch.
 - c. Remote Thermostats, conduit, wiring, and controllers.
 - 3. Controls Interface:
 - a. Relay board.
 - b. 24-volt transformer.
 - 4. Provide ASHRAE Cycle I as defined in ASHRAE (HVACA) Handbook HVAC Applications.
- M. Filter: Easily removed 1 inch thick glass fiber throw-away type, located to filter air before coil.
- N. Mixing Dampers: Multi-blade with compressible seal, capable of varying proportion of mixed air from 100 percent room air to 100 percent outside air.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are suitable for installation.
- B. Verify that field measurements are as indicated on drawings.

C. PREPARATION

- D. INSTALLATION
 - 1. Install in accordance with manufacturer's recommendations.
 - 2. Install equipment exposed to finished areas after walls and ceilings are finished and painted.
 - 3. Do not damage equipment or finishes.
 - 4. Unit Ventilators:
 - a. Locate as indicated, level and shim units, and anchor to structure.
 - b. Coordinate exact location of wall louvers.
 - c. Install shelving and auxiliary cabinetry.
 - d. Provide wall trim pieces for continuous wall-to-wall installation.
 - 5. Units with Cooling Coils: Connect drain pan to condensate drain.
 - 6. Blower-Coil Units:
 - a. Install in accordance with manufacturer's recommendations.
 - b. General piping installation requirements are specified in other Sections and drawings
 - indicate general arrangement of piping, fittings, and specialties.
 - 7. Air Coils:
 - a. Install in ducts and casings in accordance with SMACNA (DCS).
 - 1) Support coil sections independent of piping on steel channel or double angle frames and secure to casing.
 - 2) Provide frames for maximum of three coil sections.
 - 3) Provide airtight seals between coil and casing or duct.
 - b. Coil Safeguards:
 - 1) Protect coils to prevent damage to flanges and fins.
 - 2) Comb out damaged fins.
 - c. Install all coils level except cleanable coils with 1:50 pitch.
 - d. Make connections to hydronic and steam coils with unions and flanges.
 - e. Hydronic (Drainable) Coils:
 - 1) Connect water supply to leaving air side of coil (counterflow arrangement).
 - 2) Locate supply water connection on leaving air side at bottom of supply header, and return water connection at top.
 - 3) Provide manual air vents with stop valves at high points.
 - (a) Install drain connections at low points of installation.
 - f. Cooling Coils:
 - 1) Cooling Condensate Drain Pan and Drain Connection:
 - (a) Fabricate from galvanized 20 gage, 0.0359 inch sheet steel, extend 3 inches from face of entering air side, 6 inches from the face of the leaving air side, and 4 inches from the face of moisture eliminators.
 - (b) Design slope in accordance with ASHRAE Std 62.1 and install to prevent standing water.
 - (c) Pipe drains individually to floor drain with water seal trap.
 - 2) Install condensate drain pan under each main cooling coil and intermediate condensate drain pan at each level of stacked cooling coils to collect all condensate from coil assembly, pipe header, pipe return bends, upstream runoff, and downstream carry-over.
 - g. Steam Coils:
 - 1) Install vacuum breaker in steam line at or in header.
 - 2) Install steam traps with outlet minimum of 12 inches below coil return connections.
 - h. Refrigerant Coils:
 - 1) Provide sight glass in liquid line within 12 inches of coil.
- E. CLEANING
 - 1. After construction and painting is completed, clean exposed surfaces of units.

- 2. Vacuum clean coils and inside of units.
- 3. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.
- 4. Install new filters.
- F. CLOSEOUT ACTIVITIES
 - 1. See Section 01 7800 Closeout Submittals, for closeout submittals.
 - 2. See Section 01 7900 Demonstration and Training, for additional requirements.
- G. PROTECTION
 - 1. Provide finished cabinet units with protective covers during the balance of construction.

END OF SECTION

SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Electrical equipment coordination and installation
 - 2. Sleeves for raceways and cables
 - 3. Sleeve seals
 - 4. Common electrical installation requirements
 - 5. Supporting devices for electrical components
 - 6. Cutting and patching for electrical construction
 - 7. Touchup painting

1.03 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. Provide: Furnish and install.
- C. Directed: Directed by the A/E.
- D. Indicated: Indicated in the Contract Documents.
- E. Concealed: Hidden from normal sight. Includes items in shafts, pipe and duct spaces and above ceilings.
- F. Exposed: Not concealed. Work within equipment rooms and all visible (normal sight) work shall be considered "exposed".

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Electrical System Studies.
- 1.05 QUALITY ASSURANCE
 - A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.06 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 that connecting raceways, cables and wireways 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 chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- E. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent, are tested to demonstrate successful interoperability.

1.07 GENERAL REQUIREMENTS

- A. Nothing contained in these "SPECIFICATIONS" or shown on the "DRAWINGS" shall be so constructed as to conflict with any local, municipal, or State laws or regulations governing the installation of electric or other work specified herein, and all such ordinances and regulations, including the National Electrical Code, are hereby incorporated and made a part of these specifications. All such requirements shall be satisfied by the Contractor and at no additional cost to the Owner.
- B. Due to the small scale of drawings, it is not possible to indicate all conduits, conductors, boxes, fittings, switches, and similar parts which may be required. The contractor shall investigate the structural and finish conditions affecting the work and arrange all work accordingly furnishing such parts and equipment as may be required to meet building conditions.
- C. Contractor shall lay out work from dimensions of architectural and structural drawings and actual dimensions of equipment being installed. Layouts in congested areas should not be scaled from mechanical or electrical drawings.
- D. The Drawings are indicative of the character and scope of the work and are not intended to show all the details.
- E. The actual location of all wiring, outlets, and equipment shall be determined at the site.
- F. The Drawings shall be carefully checked, to ensure that all equipment, as shown, will operate satisfactorily in the space allotted to it.

G. Generally, major equipment of the system is located on the floor plans and the interconnecting conduit and wiring are indicated on the diagrams or called for in the Specifications.

1.08 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 all applicable requirements of NFPA 70, National Electrical Code.
- C. Testing Agency: Use a NETA accredited electrical testing agency, or approved equal, that is accredited for the region in which the Contract work is performed. Refer to Section 26 0563.

1.10 REGULATIONS

- D. All electrical work, equipment and material furnished or installed under this contract shall conform to the requirements of latest applicable codes and any other Governmental or Local Authorities having jurisdiction and all rules and regulations of the Utility Company involved. Nothing mentioned in the specifications or indicated on the drawings shall be construed to conflict with the mentioned codes, ordinances, and regulations.
- E. All materials furnished, and all work installed, shall comply with the latest issue of the codes, rules, regulations, and recommendations of the following bodies, unless otherwise noted:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society of Testing and Materials (ASTM)
 - 3. International Building Code (IBC)
 - 4. International Energy Conservation Code (IECC)
 - 5. Insulated Power Cable Engineers Associate (IPCEA)
 - 6. Insulated Cable Engineers Associate (ICEA), formerly IPCEA.
 - 7. Illuminating Engineering Society (IES)
 - 8. Institute of Electrical and Electronic Engineers (IEEE)
 - 9. National Electrical Code (NEC)
 - 10. National Electrical Manufacturers Association (NEMA)
 - 11. National Fire Protection Association (NFPA)
 - 12. National Electrical Safety Code (NESC)
 - 13. National Electrical Contractors Association (NECA)
 - 14. Occupational Safety and Health Agency (OSHA)
 - 15. Underwriters Laboratories, Inc. (UL)
 - 16. City or Local Code(s)
 - 17. Pennsylvania Department of Labor and Industry (L&I)
 - 18. Pennsylvania Department of Health (DoH)
 - 19. National Board of Fire Underwriters
 - 20. Americans with Disabilities Act (ADA)
 - 21. City of Philadelphia Electrical Code
 - 22. Other codes, as applicable

1.11 ELECTRICAL SYSTEM STUDIES

- A. Prepare and submit a Short Circuit, Arc-Flash, and Protective Device Coordination Study as specified in this Article.
 - 1. Immediately after award of the Contract, collect all data needed to perform calculations for the studies.

- a. Obtain, in writing, electrical utility source information and any other information required from the utility to perform the necessary studies directly from the serving utility.
- b. The Owner will provide, as available, information about the portions of the facility's existing electrical system affected by the work performed under this Contract.
 - The Owner will provide copies of the latest revision of the existing facility record drawings to the Contractor for use in defining existing equipment load requirements.
 - 2) Base the contribution of motors on actual motor loads as indicated on the equipment list, system one-line diagrams, and panel schedules.
 - 3) If the information provided is insufficient to perform the studies or represents unknown ratings of existing equipment, investigate and obtain the information required.
 - a) Employ qualified technicians to obtain the necessary data.
- c. Obtain data for new equipment directly from suppliers and other contractors working on the project.
- 2. Once the data needed is obtained, perform a preliminary computerized Short Circuit, Arc-Flash, and Protective Device Coordination Study, complete with initial calculations.
 - a. At least two full calendar weeks prior to submitting Shop Drawings for equipment included the respective studies, submit the preliminary studies and corresponding computer printouts and annotated one-line distribution diagram to the Engineer for review and comment.
 - b. After the Engineer provides his comments, submit four copies of the revised and corrected preliminary studies.
- 3. Include the following types of information common to each study:
 - a. Calculations and tabulations.
 - 1) Ensure that the calculations in the Short Circuit, Arc-Flash, and Protective Device Coordination Study are sufficient to ascertain interrupting and/or withstand ratings of the equipment.
 - a) Identify items of distribution system equipment that are not rated for the available fault current and provide corrective recommendations for consideration.
 - b. Data on the computer programs used to perform calculations and tabulations.
 - c. An appendix to each report that includes the information obtained from outside entities, agencies, electrical manufacturers, the serving utility company, field inspections, and other field sources such as the following:
 - 1) Copies of letters.
 - 2) Photographic records.
 - 3) Nameplate tracings.
 - 4) Actual data sources from which the data and information was obtained.
- B. Final Project Report:
 - 1. After the Engineer accepts the revised and corrected preliminary studies, prepare a report summarizing the results of the individual studies; and submit this Final Project Report to the Engineer for acceptance and approval.
 - a. Include the following sections in the Final Project Report:
 - 1) Description.
 - 2) Purpose.
 - 3) Basis and scope of the study.
 - 4) A single line diagram of that portion of the power system that is included within the scope of the study.
 - 5) Computerized time versus current coordination graphs and corresponding printouts for protective devices.
 - a) Include the feeder cable damage curves associated with the items being coordinated in these graphs.

- b) Include the ANSI/NEMA MG 1 damage points for the motors in the system and the ANSI/IEEE C57.12.00 mechanical and electrical damage points on the curves.
- 6) Tabulations of the relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
- 7) Harmonic data at Points-of-Common-Coupling (PCC).
- b. Submit ten bound copies of the Final Project Report for review and approval and two copies of record drawings showing the existing facility as it was before the work of this Contract was performed.
- c. Once the Final Project Report has been approved, forward one additional bound final copy of the report to the Owner.
- C. Short Circuit, Arc-Flash, and Protective Device Coordination Study:
 - 1. Prepare the Short Circuit, Arc-Flash, and Protective Device Coordination Study under the supervision of a Professional Engineer, licensed in the Commonwealth of Pennsylvania, or have a NETA certified electrical testing laboratory employing technicians certified according to ANSI/NETA ETT prepare it.
 - a. Perform the short circuit portion of the Study in accordance with ANSI/IEEE C37.10, ANSI/IEEE C37.13, ANSI/IEEE 141, ANSI/IEEE 242, and ANSI/IEEE 399.
 - Calculate short circuit momentary duty values and interrupting duty values on the basis of the following short circuit conditions at every distribution transformer, secondary and primary terminal at every bus in every switchboard, motor control center, distribution panelboard, branch circuit panelboard and at terminals of utilization equipment whether it be Electrical, Process, HVAC, Plumbing or Instrumentation that is either 480V or 208V, 3phase and rated 15 Amps or higher. Include:
 - a) Single line to ground fault.
 - b) Bolted three-phase line to ground fault.
 - c) Double line (line to line) to ground fault.
 - b. Perform the arc flash portion of the Study for the electrical distribution equipment in accordance with NFPA 70E and ANSI/IEEE 1584.
 - 1) Perform the analysis under worst-case arc-flash conditions; and if applicable, describe in the final report how these conditions differ from worst-case bolted fault conditions.
 - 2) Provide the following items for each circuit and arc location analyzed:
 - a) Printed hardcopy of calculations performed.
 - b) Arcing fault magnitude.
 - c) Device clearing time.
 - d) Duration of arc.
 - e) Arc flash boundary distances.
 - f) Working distance.
 - g) Arc flash incident energy.
 - h) Hazard risk category.
 - i) Personal-protective equipment classes.
 - j) Arc flash warning labels as specified in Section 26 05 23.
 - k) Recommendations and potential options for arc flash energy reduction to reduce the Incident Energy levels where they are calculated to be over the 40 cal/cm2.
 - I) Maintenance procedures/guidelines in accordance with the requirements of NFPA 70E for the Owner.
 - c. Coordinate protective devices with systems and equipment by providing the necessary calculations and logic decisions required to select or to check the selection of power fuse ratings, ratios and characteristics of associated current transformers, and breaker trip characteristics and settings and distribution system fuses.

- 1) Provide coordination plots for phase and ground protective devices on a system basis.
 - a) Adhere to National Electrical Code restrictions and maintain proper coordination.
 - b) Provide a sufficient number of separate curves to clearly indicate the coordination achieved.
- 2) Computer-generate time-current characteristics of the specified protective devices on log-log scale plots.
 - Include complete titles, the respective one-line diagram and identifying legends, associated relays or fuse characteristics, significant motor starting characteristics, complete operating bands of low voltage circuit breaker trip curves and fuses.
 - b) Indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush, through-fault current duration per ANSI/IEEE C57.12.59, dry-type transformers withstand, cable thermal overcurrent withstand limits, symmetrical fault currents and motor full load current, locked-rotor current, and magnetizing inrush in the coordination plots.
- 3) Provide the selection and settings of the protective devices separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment, and recommended settings.
 - a) Use the information from the Study to obtain optimum device protective and coordination performance.
- 2. In addition to the information common to the studies as listed in Subparagraph 1.11 A 3, include the following information specific to short circuit, arc-flash, and protective device coordination distortion only in the Short Circuit, Arc-Flash, and Protective Device Coordination Study:
 - a. Complete short circuit and protective device coordination studies, including coordination plots, for the following electrical distribution systems serving the entire facility:
 - 1) Utility (primary) voltage service
 - 2) Low voltage service/distribution system.
 - 3) Low voltage 208Y/120 volts, 3 phase, 4 wire distribution systems.
 - b. Power company supply and network characteristics, including the following:
 - 1) The base quantities selected.
 - 2) Source impedance data and impedance diagrams.
 - 3) One-line diagrams.
 - 4) Calculation methods and tabulations.
 - a) Include short circuit tabulations of the fault impedance, X to R ratios, asymmetry factors, KVA, symmetrical and asymmetrical fault currents, and all multiplying factors.
 - 5) Conclusions and recommendations.
 - c. Motor starting characteristics for motors 50 HP and above.
 - d. Provide sufficient information in the study to ensure adequate protection of the cables, transformers, and other equipment; to indicate proper coordination between fuses and circuit breakers; and to determine areas of the system in which additional coordination may be required.
- 3. Submit Short Circuit, Arc-Flash, and Protective Device Coordination Study information with the equipment submittals for review by the Engineer.

1.12 PERMITS AND INSPECTIONS

A. Give all necessary notices and obtain all required permits. Pay all fees and other costs, including utility connections or extensions in connection with the work. File all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental agencies

having jurisdiction. Obtain all required certifications of inspection and deliver same to the Architect.

1.13 RECORD DRAWINGS

A. The Contractor shall keep accurate records of all deviations in work as actually installed from work indicated. One complete set of Contract Documents shall be available at the construction site for indicating said deviations. The Contractor shall indicate routing of all feeders, junction boxes and the like.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 Articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- B. Coordinate sleeve selection and application with selection and application of firestopping. Use UL listed materials as shown in a UL listed detail for the configuration of the penetration. Submit UL detail showing materials used.
- 2.03 MATERIALS AND EQUIPMENT
 - A. All materials and equipment furnished for the project shall be new and of first quality, produced by manufacturers of recognized reputation for each line of material or equipment. The fact that materials or equipment offered are recently developed and untried may be sufficient justification for their rejection. All materials, fittings, devices, and equipment shall be those approved by the Underwriters Laboratories, Inc., and if of the class for which the Underwriters Laboratories, Inc., provides label service, they shall bear such labels.
 - B. Where there is more than one item of equipment furnished under this Contract, the Contractor shall furnish equipment of the same type and from the same manufacturer. In no case shall the Contractor furnish similar types of equipment from different manufacturers. One manufacturer shall furnish all similar types of equipment.
- 2.04 TOUCHUP PAINT
 - A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
 - B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 EXECUTION

- 3.01 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 right of way to raceways and piping systems installed at a required slope.
- F. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- 3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS
- A. Electrical penetrations occur when raceways, cables or wireways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section, "Firestopping."
- C. 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.
- D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- 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 or cable unless sleeve seal is to be installed or unless seismic criteria require a 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 or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- K. 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 fire stop materials. Use UL listed materials as shown in a UL listed detail for the configuration of the penetration. Submit UL detail showing materials used.

- L. 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.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.
- N. Sleeves shall be provided by the Contractor for the installation of conduit, etc. The sleeves shall be carefully located in advance of the construction of walls and floors where new construction is involved. Provide all cutting and patching necessary to set sleeves which are not placed prior to construction. All cutting and patching necessary to set sleeves which are not placed prior to construction shall be the responsibility of the trade providing the sleeves.
- O. Sleeves shall be provided for all conduit, etc. passing through concrete, masonry, plaster and gypsum wallboard construction. Caulk the annular space of sleeves with an elastic fire-resistant caulking compound to make installation fire, air and water tight.
- P. Fasten sleeves securely in the construction so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into space between conduits, etc., and sleeve during construction.
- Q. Sleeves required in existing concrete or masonry walls shall be set and secured with mortar grout and fast drying bitumastic sealant.
- R. At all sleeves where objectionable noise can be transmitted, at smoke barriers, at walls above ceilings that extend to underside of the structure of floor above, or at fire rated separations, seal all openings between conduit, etc. and corresponding sleeves to prevent sound transmission and to maintain fire rating. Use UL approved resilient sealant for penetration seals. Submit method of sealing for approval. Where watertight sleeves are indicated or required to suit the installation, provide Link Seal rubber seals, as manufactured by Thunderline Corporation or approved equal, between pipe and sleeves.
- S. Where conduit motion due to expansion and contraction will occur, provide sleeves of sufficient diameter, or permit free movement of conduit. Check construction to determine proper length for various locations; make actual lengths to suit the following:
 - 1. Terminate sleeves flush with walls, partitions, and ceilings.
 - 2. Terminate sleeves 2 inches above finished floor in equipment rooms or Wet Locations.
 - 3. In all other areas, terminate sleeves 1/2-inch above finished floors.

3.03 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, 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.

3.04 FIRESTOPPING

A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Refer to Division 07 Section, "Firestopping".

- B. Use UL listed materials as shown in a UL listed detail for the configuration of the penetration. Submit UL detail showing materials used.
- 3.05 FIELD QUALITY CONTROL
 - A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.
- 3.06 WORKMANSHIP
 - A. Each subcontractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work.
 - B. The quality of the workmanship required for each trade in the execution of its work shall be the finest and highest obtainable in that trade working with the materials specified. Workmanship shall be satisfactory to the Architect and his decision as to the acceptable quality is final.

3.07 WATERPROOFING

- A. Under no circumstances shall any waterproofing be damaged or penetrated. Should conditions arise which indicate such necessity, notify the Architect. Penetrations required by this Contract shall be made watertight.
- 3.08 CUTTING AND PATCHING
 - A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
 - B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.09 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Raceways
 - 2. Supporting devices for electrical components
 - 3. Electricity-metering components
 - 4. Concrete bases
 - 5. Cutting and patching for electrical construction
 - 6. Touchup painting

3.10 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint: Paint materials and application requirements are specified in Division 09 Section, "Painting."
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.11 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
- C. Conduit and Equipment to be painted: Clean all conduits exposed to view in completed structure by removing plaster and dirt. Remove grease, oil, and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.
- D. All Items with Factory Finish: Remove cement, plaster, grease and oil, and leave all surfaces, including cracks and corners, clean and polish. Touch up any scratched or bare spots to match finish. The Architect may approve factory finish as prime coat. See "Painting" Section.
- E. Electrical equipment and materials exposed to public and in finished areas shall be finishpainted after installation to coordinate with surrounding walls. Surfaces shall be thoroughly cleaned for receiving paint. Paint color coordination shall be as directed, and on adjacent surfaces to insure proper matching of quality and color with surrounding areas.
- F. All electrical apparatus and equipment in equipment rooms shall be provided with a factory finish coat. All panels in public spaces, corridors, etc. shall be provided with a factory prime coat and field finish painted to match surrounding finishes.
- G. Site Cleaning: Remove from site all packing cartons, scrap materials, and other rubbish relating to electrical installation.
- 3.13 MECHANICAL EQUIPMENT WIRING
 - A. Furnish and install all conduit and power wiring to all safety switches, motor starters, start/stop switches, HOA switches, and thermal switches, and make final power connections to all mechanical equipment.
 - B. Provide all safety switches, motor starters, start/stop switches to mechanical equipment as indicated on the Contract Drawings.
 - C. All safety disconnect switches, motor starters, start/stop buttons, HOA switches, thermal switches, etc. for HVAC equipment, plumbing equipment, and motorized door operators shall be installed by the Electrical Contractor.
 - D. All control wiring shall be the responsibility of the respective Contractor supplying the equipment.
 - E. Coordination: Refer to Division 23 Section, "HVAC Instrumentation and Controls" to coordinate work with other trades relative to smoke damper, air handling units, and other control functions.

END OF SECTION 26 0500

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Requirements for furnishing, installing, connecting, energizing, testing, cleaning, and protecting low voltage cable, shielded cable, and accessories.
- B. Related Sections:
 - 1. Section 26 0500 Common Work Results for Electrical
 - 2. Section 26 0526 Grounding and Bonding for Electrical Systems
 - 3. Section 26 0553 Identification for Electrical Systems
 - 4. Section 26 0533 Raceways and Boxes for Electrical Systems
 - 5. Section 26 0563 Acceptance Electrical Testing

1.02 REFERENCES

- A. American Society for Testing Materials (ASTM):
 - 1. ASTM B 8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- B. Institute of Electrical and Electronic Engineers (IEEE):
 - 1. IEEE 1202 Standard for Flame-Propagation Testing of Wire and Cables
- C. National Electrical Manufacturer's Association (NEMA):
 - 1. NEMA WC 26/EEMAC 201 Binational Wire and Cable Packaging Standard
 - 2. ANSI/NEMA WC 57 Standard for Control, Thermocouple Extension, and Instrumentation Cables
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 National Electrical Code (NEC)
- E. Underwriter's Laboratories, Inc. (UL):
 - 1. UL 13 Standard for Power-Limited Circuit Cables
 - 2. UL 1581 Reference Standard for Electrical Wires, Cables, and Flexible Cords
 - 3. UL 1685 Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
- F. Insulated Cable Engineers Association (ICEA):
 - 1. ICEA T-29-520 Vertical Cable Tray Flame Test @ 210,000 BTU

1.03 DESIGN REQUIREMENTS

- A. Conductors in Raceway and Conduit Systems:
 - 1. Provide conduit systems for installing wiring that is outside of equipment.
 - 2. Except for raceway or conduit for control wires or where otherwise indicated on the Contract Drawings, design raceway and conduit systems so that the maximum number of low-voltage current carrying conductors (per NFPA 70, Article 310) in each raceway or conduit does not exceed three, plus a ground.
- B. Cable Tension Design Requirements:

- 1. Design conduit runs so that the tension limits set by the wire and cable manufacturers will not be exceeded.
 - a. Provide additional pulling points as required to limit the tension to acceptable levels.
- C. Product Data and Catalog Cuts:
 - 1. Submit low-voltage ground, power, and control wiring product data as listed below for the products provided as the Work of this Section; and clearly indicate the usage of each product on the data submitted.
 - a. Wires and cables.
 - b. Lugs.
 - c. Connectors.
 - d. Tapes.
 - e. Pulling lubricant.
 - f. Tools used to crimp connectors.
- D. Use of Trade Names:
 - 1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
 - a. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

1.04 SUBMITTALS

- A. Submit the following information to the Engineer for approval in accordance with the requirements of General Conditions:
 - 1. Product Data:
 - a. Wires and cables
 - b. Lugs
 - c. Connectors
 - d. Tape
 - e. Pulling lubricant
 - 2. Samples:
 - a. Wire samples
 - 3. Quality Assurance/Control Submittals:
 - a. Certificates:
 - 1) Testing agency/quality verification
 - b. Manufacturer's Instructions:
 - 1) Cable manufacturer's recommendations
 - c. Qualification Statements:
 - 1) Documented experience of the installing firm
 - 2) Qualifications of the licensed electricians supervising the Work

1.05 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer Qualifications:
 - a. To install the Work of this Section, employ the services of a firm specializing in installing wire, cable, and accessories, and that has a minimum of 3 years experience doing so.
 - 1) Submit the documented experience of the firm installing the wire, cable, and accessories.
 - b. To supervise installation of the Work of this Section, employ licensed electricians.
 - 1) Submit the qualifications of the licensed electricians supervising the Work of this Section.

- B. Regulatory Requirements:
 - 1. Perform the Work of this Section in accordance with the requirements specified in NFPA 70, and to all other applicable state, local, and national governing codes and regulatory requirements.
- C. Certifications:
 - Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and the application intended, unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products.
 - a. Provide copper conductors listed and labeled by UL for all wiring.
 - 2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data either by providing a printed mark on the data or by attaching a separate listing card.
 - a. For items without such evidence, submit a written statement from the product manufacturer that indicates why it does not have quality assurance verification.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling, and Unloading:
 - 1. Imprint insulated conductors with the date of manufacture, the wire type, and the manufacturer.
 - 2. Package wire and cable in conformance with the requirements of NEMA WC 26/ EEMAC 201.
 - 3. Protect items from damage during delivery, handling, and installation.
 - a. Comply with the cable manufacturer's recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable.
 - b. Submit the cable manufacturer's recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable
- B. Acceptance at Site:
 - 1. Wire and cable manufactured more than 12 months before delivery to the Site is unacceptable for use under this Contract, and will be rejected.
- C. Storage and Protection:
 - 1. Store products indoors on blocking or pallets.
 - 2. Protect items from damage during storage.

PART 2 PRODUCTS

1.

- 2.01 LOW VOLTAGE CONDUCTORS
 - A. Conductor Design Requirements:
 - Provide conductors of proper size and ampacity ratings based on Article 310 of NFPA 70.
 - a. Provide copper conductors that have 98 percent conductivity.
 - b. Unless otherwise indicated on the Contract Drawings, at a minimum provide conductors of the following American Wire Gauge (AWG) sizes:
 - 1) For power and branch feeder circuits: 12 AWG.
 - a) For power and branch feeders, provide solid copper low-voltage conductors for sizes up to and including 10 AWG; provide stranded copper low-voltage conductors for 8 AWG and larger sizes.

- 2) For control circuits: 14 AWG.
- 3) For alarm and status circuits: 14 AWG.
- B. Insulation Design Requirements:
 - 1. Provide low voltage ground, power, and control wiring having the proper insulation types as follows:
 - a. For exterior, wet, and damp locations: Type XHHW-2
 - b. For wiring that is wholly in dry indoor locations: dual-rated Type THHN/THWN.
 - c. For ground wires: THW may be used at the Contractor's option.
 - 2. Color Coding of Wires:
 - a. Insulation shall be color coded in accordance with requirements of Section 26 05 53.
 - 3. Available Manufacturers:
 - a. Continental Wire & Cable Company
 - b. SouthWire
 - c. General Cable
 - a. CME Wire & Cable Inc.
 - b. Or Approved Equal

2.02 MATERIALS

- A. 600 Volt Rated Multi-Conductor Cable:
 - 1. Provide multi-conductor cable that is suitable for use indoors or outdoors; exposed or concealed; as open wiring; in any raceway, underground duct, or cable tray.
 - a. Provide cable that is UL listed for 90 degrees Celsius dry or wet, for direct burial, for cable tray use, and as sunlight resistant.
 - 2. Assemble the cable with non-hygroscopic fillers and binder tape.
 - a. Insulated Conductors:
 - 1) Provide uncoated stranded copper conductors, complying with the requirements of ASTM B 8 for Class B conductors.
 - 2) Provide cross-linked polyethylene type XHHW-2 insulation rated for 600 volts.
 - b. Grounding Conductors:
 - 1) Provide uninsulated copper conductors.
 - c. Cover the overall assembly with a single strip of interlocked aluminum tape, and then apply an outer final jacket of black flame-retardant PVC.
 - 3. Available Manufacturers:
 - a. General Cable Technologies Corporation
 - b. The Okonite Company
 - c. Or Approved Equal

2.03 ACCESSORIES

- A. Cable Pulling Lubrication and Lubricant:
 - 1. Lubricant shall provide reduced tension on all types of cable jackets, dry to a thin lubricating film that retains its lubricity for an extended period and won't cement in the cables.
 - 2. The cable pulling lubricant shall produce a low coefficient of friction on a wide variety of cable jacket materials. The lubricant shall be UL listed. It shall be easy to handle and adhere well to the cable. Where appropriate, it shall also be tested and approved for use with CSPE (chlorosulfonated polyethylene) fire-retardant cable jackets where these materials are utilized.
 - 3. The lubricant shall be UL or CSA Listed and Labeled and shall pass the IEEE 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable. It shall pass physical compatibility tests on LLDPE, XLPE, CPE, and PVC cable

jacket or sheath materials. It shall not stress crack polyethylene per ASTM Standard 1693. There shall be no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when the lubricant's effect on volume resistivity is tested according to IEEE Standard 1210.

- 4. Lubricant to be specification-grade type that does not promote flame propagation when used with fire-retardant cables and systems, is harmless to humans, environmentally safe, and compatible with all common cable jacket materials
- 5. The lubricant shall contain no waxes, greases, silicones, or polyalkylene glycol oils or waxes. The lubricant shall have less than a 6.0% solids residue after drying for 24 hours at 105°C.
- 6. Where CPE insulated wire and/or cable is rated for Low Smoke / Zero Halogen type, only Polywater Type LZ shall be utilized.
- 7. Specific lubricants for fiber-optic and other special cable installations shall be determined by the cable / lubricant manufaturers and the Contractor shall provide submittal information, including MSDS documentation and other information verifying suitability of products and general specification compliance as outlined herein.
- 8. Available Manufacturers:
 - a. PolyWater DynaBlue
 - b. 3M Type WL
 - c. Greenlee Type GEL
- B. Grounding Braid:
 - 1. Provide conformable, all-metal (tinned copper wires), corrosion resistant, woven grounding braid having a high current-carrying capacity approximately that of 6 AWG wire, such as.
 - 2. Available Manufacturers:
 - a. 3M, Scotch, Scotch[®] 25 Electrical Grounding Braid,
 - b. Plymouth
 - c. Permacel
 - d. Or Approved equal
- C. Tapes:
 - 1. Vinyl Insulating Tape:
 - a. Provide UL-listed flexible polyvinyl chloride (PVC) backed insulating tape with a pressure sensitive adhesive, such as black Scotch[®] 33+ Vinyl Electrical Tape, that is resistant to abrasion, acids, alkalis, and copper corrosion; resistant to, hot, cold and wet weather; and resistant to damage from UV sunlight exposure.
 - 2. Rubber Splicing Tape:
 - a. Provide highly conformable, linerless, self-bonding, ethylene rubber (EPR), highvoltage (through 69 kV) insulating tape formulated to provide excellent thermal dissipation of splice heat, and designed to insulate splices and terminate cables whose overload temperatures can reach 130 degrees Celsius, such as Scotch[®] 130C Linerless Rubber Splicing Tape.
 - 3. Available Manufacturers:
 - a. 3M, Scotch
 - b. Plymouth
 - c. Permacel
 - d. Or Approved equal
- D. Wire and Cable Connections:
 - 1. Grounding Connectors:
 - a. Provide grounding connectors conforming to the requirements of Section 26 05 26 Grounding and Bonding for Electrical Systems.
 - 2. Connectors for Service Wires and Cables, and for Wires and Cables Larger Than Number 6:
 - a. Split Bolt Connectors or Compression Type Connectors:

- 1) Provide UL-listed split bolt connectors or compression type connectors for making parallel or butt splices of stranded copper wire.
- 2) Use companion preformed plastic insulating covers or tape insulation conforming to NFPA 70 (NEC) requirements.
- b. Mechanical compression connectors:
 - 1) Provide mechanical compression connectors that are capable of connecting single or multiple conductors, and of being installed with one wrench.
 - a) Type: Compact, two-hole mechanical compression connectors having two clamping bolts.
 - (1) Connector Body: Provide a high copper bronze or brass alloy body.
 - (2) Bolts: Provide brass or bronze bolts; plated steel screws are unacceptable.
 - (3) Fasteners: Provide silicon-bronze fasteners for bolting connectors to connections.
- c. Crimped Compression Connectors:
 - 1) Provide two-hole crimped compression type connectors fabricated from high conductivity, seamless, electrolytic wrought copper, electrolytically tin-plated, and color coded to match the dies.
 - 2) Provide crimped compression type connectors with adequate area to conduct the electrical current.
 - 3) To crimp connectors, provide crimping tools from the same manufacturer that manufactured the connectors.
- 3. Control Wiring Connections:
 - a. For control wiring connections at terminal boards, provide crimped nylon-insulated ring terminals.
 - b. For control wiring splices, provide nylon insulated butt splices with insulation grips.
 - c. For joining more than two control wires, provide junction boxes with terminal boards.
- 4. Connectors for Other Conductors:
 - a. Any of the applicable types listed for larger wire may be provided.
 - b. Screw Terminal Connections:
 - 1) For making terminal connections of stranded copper wire to screw terminals, provide nylon insulated crimped compression terminals with copper barrel on the wire.
 - 2) For making terminal connections of solid copper wire to screw terminals, provide screw lock connectors.
 - c. Wire Nuts:
 - 1) For making splices of copper wire, provide pre-insulated, UL-listed, solderless connectors of the spring-lock or compression type that can be installed by hand or using tools.
 - 2) For site lighting, wire nuts used in underground or below grade locations is prohibited. There only permitted use for site lighting is within a pole base.
 - d. Available Manufacturers:
 - 1) Thomas & Betts Corp.
 - 2) Tyco Electronics, AMP Inc.
 - 3) Ilsco Corp.
 - 4) FCI-Burndy[®] Products
 - 5) Or Approved equal

2.04 SOURCE QUALITY CONTROL

- A. Tests:
 - 1. 600 Volt Rated Multi-Conductor Cable:
 - a. 70,000 BTU/hr Vertical Tray Flame Test:
 - 1) 600 Volt rated multi-conductor cable must pass the vertical tray flame test requirements of UL 1569, IEEE 383, and IEEE 1202.
 - b. 210,000 BTU/hr Vertical Tray Flame Test:

1) 600 Volt rated multi-conductor cable must pass the vertical tray flame test requirements of ICEA T-29-520.

PART 3 EXECUTION

3.01 INSTALLERS

A. Install the work of this Section only under the supervision of licensed electricians.

3.02 EXAMINATION

- A. Inspect all conduits, junction boxes, electrical vaults, and handholes to verify that they are clean, that they do not have burrs, that conduits are properly aligned, and that they are complete.
 - 1. Ensure that on all conduits without threaded hubs, two locknuts are installed.
 - 2. Ensure that in all conduits with wires larger than No. 10, bushings are installed.
 - 3. Ensure that grounding bushings and fittings are installed at all places specified in Section 26 0526, "Grounding and Bonding".
 - 4. Verify that proper sized boxes are installed.
- B. Verify that boxes and conduit fittings conform to the bending requirements specified in Article 314 of NFPA 70 (NEC).

3.03 PREPARATION

- A. Verify that pulling calculations have been made and are available for long conduit runs and pulls as indicated in this Section.
- B. Do not begin installing wiring until other work which might cause damage to the wires, cables, or conduits has been completed.
 - 1. Correct deficiencies in conduits, junction boxes, and raceways that have been discovered by the inspection required in Paragraph 3.02.A.
- C. Prepare conduits to receive wire and cable.
 - 1. Swab the conduits with a nylon brush and steel mandrel.
 - 2. Pre-lubricate the conduits for which the pulling tension calculations are based on a coefficient of friction less than that of a dry conduit.
- D. Verify that a means of controlling the pulling tension on the wire or cable is installed on the mechanical assist devices furnished for pulling cable.
- E. Take the necessary precautions to prevent water, dirt, or other foreign material from accumulating in the conduits during the execution of wiring work.

3.04 INSTALLATION

- A. Low Voltage Ground, Power, and Control Wiring:
 - 1. Install Type CL2P, FPLP, or CMP cable as required by the application in accordance with the requirements of NFPA 70 (NEC).
 - a. For exposed low voltage wiring, use plenum cable.
 - b. For low voltage wiring concealed from view, only install wiring in the accessible locations permitted by the Contract Drawings.
 - 2. Neutral Conductors:
 - a. For each single-phase and each multi-phase feeder, provide separate neutrals.

- b. For branch circuits, except at three-phase, wye-connected panelboards, provide separate neutral conductors.
 - 1) For three-phase, wye-connected panelboards, a common, or "shared", neutral from three (3) adjacent single-pole circuit breakers, or from the poles of the same multi-pole circuit breaker, may be provided unless otherwise specified.
 - a) Do not utilize shared neutrals for receptacle circuits.
 - b) Do not utilize shared neutrals for control circuits or circuits serving electronic equipment.
 - c) Do not utilize shared neutrals for circuits serving LED lighting fixtures.
- c. Size each neutral conductor the same as the largest phase conductor.
- 3. Equipment Ground Conductors:
 - a. Provide a green equipment ground conductor with all runs.
 - 1) Provide equipment ground conductor wire type as specified in Section 26 0526, Grounding and Bonding.
- B. Pulling Cable:
 - 1. Establish a feed-in located at the highest elevation of the run, and pull cables down grade using flexible cable feeds to convey cables into raceways through the feed-in point opening.
 - a. Furnish quadrant blocks located properly along the cable run.
 - b. Limit cable pulling tensions to the maximum pulling tensions recommended by the cable manufacturer.
 - 1) Measure the cable pulling tension on all runs pulled with mechanical assistance and for all cable runs where calculations are required to be submitted by using a dynameter.
 - Remove cables subjected to excessive bending and tension and that are cracked or have damaged or nicked outer jackets from the Site, and replace these cables with new undamaged cables.
 - a) If pulling tension is exceeding during pulling, remove the affected cables and mark them as not to be reused.
 - c. Lubricate cables with lubricants during pulling.
- C. Terminating Cable:
 - 1. Terminate cable using materials and methods indicated or specified herein, or in accordance with the written instructions of the cable manufacturer or termination kit manufacturer.
 - a. For equipment connections, provide split bolt or compression type connectors, mechanical compression connectors, or crimped compression type connectors as specified and approved by the equipment manufacturer; for all other types of connections provide connectors of one of the types specified:
 - 2. Protect insulated power and lighting cable terminations from accidental contact, deterioration of coverings, and moisture by using proper terminating devices and materials.
- D. Splicing Wire and Cable:
 - 1. All new conductors shall be continuous from end to end without splices, except where indicated on the drawings or with the special written permission of the Engineer on a case-by-case basis where the Contractor can demonstrate that installation without splices is not practical.
 - 2. If permitted as noted above, splice cables in accessible locations.
 - 3. Within outlet or junction boxes, make wire and cable splices that conform to the requirements of NFPA 70 (NEC).
 - a. Install these outlet or junction boxes in accessible locations.
- E. Wiring Identification:
 - 1. Color code all wires and cables as indicated in Section 26 0553.

- 2. Identify all power wiring by circuit and panelboard numbers.
- 3. Identify all control wiring with wire numbers.
- 4. Provide additional electrical identification of cabling and wiring as specified in Section 26 0553, "Identification for Electrical Systems".
- F. Refer to Section 26 0500 for requirements for measuring and recording of conductor lengths.

3.05 FIELD QUALITY CONTROL

- A. Site Tests:
 - 1. Prior to energizing wire and cable, field test wires and cables as specified in Section 26 0563, "Acceptance Electrical Testing".
- B. Verify that control wiring wire numbers correspond to the numbers indicated in the record drawings.

END OF SECTION 26 0519

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SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.03 SUBMITTALS

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

1.04 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 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 UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.01 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

2.02 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory 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, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Clamps and Non-Welded Connectors:
 - 1. Provide bronze or brass clamps and connectors that are UL Listed for use below grade
 - 2. All bolts and other materials shall be bronze or brass; plated-steel screws or other hardware are unacceptable
 - 3. Provide bolts, nuts, lock-washers, and similar hardware designed not to damage ground wire.

2.03 GROUND RODS

- A. Provide UL Listed, sectional ground rods fabricated using an electrolytic plating process to copper clad a medium carbon steel core.
- B. Diameter: 3/4 inch.
- C. Length: 10 feet.
 1. To obtain longer length rods, join rod sections using copper-clad rod couplers.
- 2.04 COATING COMPOUND
 - A. Provide permanently pliable, moldable, un-backed, black rubber-based coating materials for covering or coating ground clamps and connectors
 - B. Coating Physical Properties:
 - 1. Solids/Density: 100 percent; 12 pounds per gallon
 - 2. Penetration: Within 90 to130 when tested in accordance with ASTM D 5
 - 3. Water Absorption: 0.10 percent, maximum, when tested in accordance with ASTM D 570
 - 4. Dielectric Strength: 500 volts/mil when tested in accordance with ASTM D 149
 - 5. Volume Resistivity: 2,000 megohm-inches, or 5,000 megohms-cm, when tested in accordance with ASTM D 257
 - 6. Service Temperature: Minus 40 degrees to 160 degrees Fahrenheit; and having no melting point; flammability, or slow burning when tested in accordance with ASTM C 653
 - 7. Chemical Resistance:
 - a. Resistant to alcohol, water, aqueous hydrochloride, and sodium hydroxide
 - b. Dissolved by carbon tetrachloride, naphtha gasoline, mineral spirits, and benzene.
 - 8. Cohesive/Adhesive: Adheres to metals, concrete, and itself.

PART 3 EXECUTION

3.01 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits
 - 2. Lighting circuits
 - 3. Receptacle circuits
 - 4. Single-phase motor and appliance branch circuits
 - 5. Three-phase motor and appliance branch circuits
 - 6. Flexible raceway runs

3.02 INSTALLATION

- A. General:
 - 1. Layout the electrical work to suit actual field conditions and in accordance with accepted industry standard practice
 - 2. Verify existing conditions are as expected and ready for installation of grounding materials prior to commencement of the installation
 - a. Perform field measurements to discover offsets and fitting requirements
 - b. Locate on-site utilities and other obstructions in the area of work and verify that interferences will not occur.
 - 3. Clean paint, grease, and other such insulating materials from contact points of grounds
 - 4. After inspection by Owner's Representative, and prior to backfilling the excavation, apply protective coating compound to all grounding connections located underground.
 - a. Coatings shall be allowed to cure for the minimum required time period, as recommended by the coating manufacturer, prior to backfilling of the excavation.
- B. 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.
- C. 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 so vibration is not transmitted to rigidly mounted equipment.
- D. Grounding and Bonding for Piping:
 - 1. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

- B. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
- C. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
- D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify the Engineer promptly, and include recommendations to reduce ground resistance.

END OF SECTION 26 0526

SECTION 26 0528

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Requirements for furnishing, installing, cleaning, and protecting hanger and support systems for electrical wiring, conduit boxes, and equipment.
- B. Related Section:
 - 1. Section 26 0500 Common Work Results for Electrical

1.02 REFERENCES

- A. American Iron and Steel Institute (AISI):
 - 1. AISI Standard Steels (Handbook)
- B. American Society for Testing Materials (ASTM):
 - 1. ASTM A 36/A 36M Standard Specification for Carbon Structural Steel
 - 2. ASTM A 53/A 53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated - Welded and Seamless
 - 3. ASTM A 123/A 123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 4. ASTM A 153/A 153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 5. ASTM A 283/A 283M Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
 - 6. ASTM A 325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi, Minimum Tensile Strength
 - 7. ASTM A 500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - 8. ASTM A 563 Standard Specification for Carbon and Alloy Steel Nuts
 - 9. ASTM A 575 Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
 - 10. ASTM A 576 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
 - 11. ASTM A 635/A 635M Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled
 - 12. ASTM A 1011/A 1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 - 13. ASTM B 633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 14. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
- C. American Welding Society (AWS):
 - 1. AWS D1.1/D1.1M Structural Welding Code Steel
- D. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts maximum)

- E. National Fire Protection Association (NFPA):
 - 1. NFPA 70 National Electrical Code (NEC)
 - 2. NFPA 258 Standard Research Test Method for Determining Smoke Generation of Solid Materials
- F. Society of Automotive Engineers International (SAE):
 - 1. SAE J 429 Mechanical and Material Requirements for Externally Threaded Fasteners
- G. The Society for Protective Coatings (SSPC):
 - 1. SSPC Painting Manual:
 - a. SSPC-SP 2 Hand Tool Cleaning
 - b. SSPC-Paint 15 Paint Specification No. 15, Steel Joist Shop Paint, Type I, Red Oxide Paint, Type II, Asphalt Coating
 - c. SSPC-Paint 20 Paint Specification No. 20, Zinc-Rich Primers (Type I, "Inorganic," and type II, "Organic")
- H. Underwriters Laboratory, Inc. (UL):
 - 1. UL 568 Nonmetallic Cable Tray Systems
 - 2. UL 635 Standard for Insulating Bushings
 - 3. UL 870 Standard for Wireways, Auxilliary Gutters, and Associated Fittings
 - 4. UL 884 Standard for Underfloor Raceways and Fittings
 - 5. UL 1479 Standard for Fire Tests of Through-Penetration Firestops
 - 6. UL 2239 Hardware for the Support of Conduit, Tubing, and Cable
- I. U. S. General Services Administration (GSA)
 - 1. Federal Specifications:
 - a. A-A-1922A Shield, Expansion (Caulking Anchors, Single Lead)
 - b. FF-S-107C (2) Screws, Tapping and Drive
- 1.03 SUBMITTALS

3.

- A. Submit the following information to the Engineer for approval in accordance with the requirements of Supplementary Conditions SC-19 Shop Drawings/Samples, and Section 26 0500, Basic Electrical Materials and Methods:
 - 1. Product Data:
 - a. Provide product data and catalog cuts for the products provided under this Section.
 - 2. Shop Drawings:
 - a. Provide Shop Drawings for equipment backboards and support structures not directly fastened to walls.
 - b. Provide Shop Drawings of hanging supports for conduit.
 - Quality Assurance/Control Submittals:
 - a. Design Data:
 - 1) Provide structural calculations for the following items:
 - a) Equipment backboards and support structures not directly fastened to the walls.
 - b) Hanging supports for conduit.
 - 2) Detailed drawings of proposed departures from the original design.
 - b. Certificates:
 - 1) Testing Agency/Quality Verification:
 - a) With the product data for electrical hangers and supports, provide evidence of quality verification, listing, and labeling by the Electrical Testing Agency (ETA); either by a printed mark on the data, or by a separate listing card.
 - b) If an item does not have ETA quality assurance verification, provide a written quality assurance verification statement from the product

manufacturer indicating why the item does not have the specified quality assurance verification.

- (1) Such quality assurance verification statements are subject to approval by the Owner and the Engineer.
- 2) Manufacturers' Certificate of Compliance.
- c. Qualification Statements:
 - 1) Manufacturers' qualifications.

1.04 QUALITY ASSURANCE

- A. Qualifications;
 - 1. Electrical Testing Agency (ETA) Qualifications:
 - a. Use the Electrical Testing Agency (ETA) qualified as specified in Section 26 05 00, Common Work Results for Electrical.
 - 2. Manufacturers' Qualifications:
 - a. Provide electrical support framing made by manufacturers that have been manufacturing support framing for a minimum of 5 years, and who carefully controls their operations to ensure that excellent product engineering, quality, safety, and reliability are achieved.
 - b. Submit the manufacturer's qualifications to the Engineer for approval.
- B. Certifications:
 - 1. Electrical Testing Laboratory (ETL) Certification:
 - a. Provide products that are listed and labeled by Underwriters Laboratory, Inc. (UL) or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) unless products meeting the requirements of these testing laboratories are not readily available or unless standards do not exist for the products.
 - 2. Manufacturers Certificate of Compliance:
 - a. Submit a manufacturer's Certificate of Compliance certifying that both the galvanizing and the products meet the requirements of the ASTM standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packaging, Shipping, Handling, and Unloading:
 - 1. Deliver, store, and handle the hangers and supports in accordance with Section 26 05 00 Common Work Results for Electrical, and as specified herein.
 - 2. Deliver material to Site in the original factory packaging.
- B. Storage and Protection:
 - 1. Shelter and store the components under cover and supported off the ground and floors on blocking.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Carbon Steel Shapes:
 - 1. Provide shapes of the sizes specified and as indicated on the Contract Drawings:
 - 2. Provide steel shapes complying with the following material specifications for the type of steel shape listed:
 - a. Steel Sections: ASTM A36/A 36M
 - b. Steel Tubing: ASTM A 500, Grade B
 - c. Plates: ASTM A 283/A 283M
 - d. Sheets: ASTM A 1011/A 1011M

- e. Pipe: ASTM A 53/A 53M, Grade B, Schedule 40, hot-dipped, zinc-coated
- B. Welding materials:
 - 1. Provide welding materials complying with the requirements of AWS D1.1/D1.1M for the type of material being welded.

2.02 MANUFACTURED UNITS

- A. Metal U-Channel Electrical Support Framing Systems and Fittings:
 - 1. Carbon Steel U-Channel Support Framing Systems:
 - a. Provide 1-5/8-inch nominal size U-channel supports fabricated from 12-gauge carbon steel electrolytically galvanized with a zinc-coating thickness commensurate with Service Condition SC 1 (mild) in conformance with the requirements of ASTM B 633.
 - For Type II ASTM B 633 galvanized finishes, fabricate the framing from steel complying with the requirements for Grade 33 specified in ASTM A 1011/A 1011M.
 - 2) For Type III ASTM B 633 galvanized finishes, fabricate the framing from steel complying with the requirements of ASTM A 575, ASTM A 576, ASTM A 635/A 635M, or ASTM A 36/A 36M.
 - b. Where combination members are required, spot-weld the members on 3-inch centers.
 - c. Provide 1-3/8-inch or larger depths, except where supports are mounted directly to walls 13/16-inch or larger depths may be provided.
 - d. Provide metal framing systems and fittings for metal framing systems from a single manufacturer.
 - e. Manufacturers:
 - 1) Unistrut Corporation, Unistrut[®] Metal Framing System, <u>www.unistrut.com</u>.
 - 2) Thomas & Betts, Kindorf[®], <u>http://elec-cat.tnb.com</u>.
 - 3) Cooper B-Line[®], Inc., <u>www.b-line.com</u>.
 - 4) Power-Strut, <u>www.power-strut.com</u>.
 - 5) Approved Equal.
 - 2. PVC-Coated Steel U-Channel Support Framing Systems:
 - a. Provide U-channel supports, fittings, threaded rod, and hardware fabricated from PVC-coated carbon steel.
- B. Conduit Supports:
 - 1. Malleable Iron Conduit Supports:
 - a. Provide one-hole style galvanized malleable iron fasteners with pipe straps similar to those as manufactured by Thomas & Betts.
 - b. Provide support devices consisting of threaded rods, channel supports, and conduit straps/fasteners.
 - 2. Stamped Steel Conduit Supports:
 - a. Provide one-hole style galvanized stamped steel fasteners with pipe straps similar to those as manufactured by Thomas & Betts.
 - b. Provide support devices consisting of threaded rods, channel supports, and conduit straps/fasteners.
 - 3. Manufacturers:
 - a. Thomas & Betts, <u>http://www-public.tnb.com/contractor/docs/superstrut.pdf</u>.
 - b. Approved equal
- C. Cable Supports:
 - 1. Provide voltage rated cable supports fabricated from hot-dip galvanized malleable iron with a threaded collar.

- 2. Provide tapered wedging cable plugs fabricated from hard fiber, impregnated hardwood, or canvas bakelite for the cable supports.
- 3. Manufacturers:
 - a. EGS Electrical Group, O-Z/Gedney, Inc., Type "M"
 - b. Approved equal
- D. Bolts, Nuts, and Washers:
 - 1. For bolts, nuts, and washers smaller than 1/4-inch trade size, provide 316 stainless steel fasteners complying with the requirements of ASTM A 325.
 - 2. For fastening galvanized components, provide stainless steel bolts, nuts, and washers galvanized in accordance with the requirements of ASTM A 325.
- E. Anchors and Fasteners:
 - 1. Drive (Deep-Pitch) Screws:
 - a. Provide Type 316 stainless steel self-tapping type drive (deep-pitch) screws that comply with the requirements of FF-S-107C (2).
 - 2. Drilled-In Anchors and Fasteners:
 - a. Provide drilled-in anchors and fasteners that comply with the requirements of FF-S-107C (2).
 - b. Masonry Anchors:
 - 1) Provide masonry anchors designed to accept both machine bolts and threaded rods as fasteners.
 - a) Provide SAE J 429 Grade 2 machine bolt fasteners fabricated from AISI Type 316 stainless steel.
 - b) Provide nuts and washers conforming to the requirements of ASTM A 563.
 - 2) Provide masonry anchors consisting of an expansion shield and expander nut contained inside the shield.
 - a) Expander Nuts:
 - (1) Fabricate square expander nuts with their sides tapered inward from the bottom to the top.
 - (2) Design the expander nuts to simultaneously climb the bolt or rod thread and expand the shield as soon as the threaded expander nut reaches and bears against the shield bottom when being tightened.
 - b) Expansion Shields:
 - (1) Provide expansion shield bodies consisting of four legs, the inside of each tapered toward the shield bottom, or nut end.
 - (2) The end of one leg shall be elongated and turned across shield bottom. Outer surface of shield body shall be ribbed for grip-action.
 - 3) Masonry Anchor Material:
 - a) Provide die cast Zamac No. 3 zinc alloy having a minimum tensile strength of 43,000 psi.
 - 4) Manufacturers:
 - a) U.S.E. Diamond, Inc., FORWAY System, , www.mktfastening.com
 - c. Concrete Anchors:
 - 1) Carbon Steel Anchor/Fastener:
 - a) Provide UL listed one-piece studs (bolts) with integral expansion wedges, nuts, and washers.
 - b) Provide carbon steel anchor/fasteners complying with the physical requirements specified in FF-S-325 for Group II, Type 4, Class 1.
 - 2) Stainless Steel Anchor/Fastener:
 - Provide one-piece AISI Type 303 or 304 stainless steel studs (bolts) with integral expansion wedges, AISI Type 316 stainless steel nuts, and AISI Type 316 stainless steel washers.
 - b) Provide stainless steel anchor/fasteners complying with the physical requirements of FF-S-325 for Group II, Type 4, Class 1.
 - 3) Acceptable Manufacturers:

- a) U.S.E. Diamond, Inc.; SUP-R-STUD, <u>www.mktfastening.com</u>
- b) Hilti Fastening Systems; KWIK-BOLT, hilti.com.
- c) Molly Fastener Group; PARABOL
- d) Phillips; RED HEAD Wedge-Anchor, <u>www.phillipsfastener.com</u>.
- 3. Hammer drive-type explosive charge drive-type anchors and fastener systems are unacceptable.
- 4. Lead shields, plastic-inserts, fiber-inserts, and drilled-in plastic sleeve/nail drive systems are unacceptable.

2.03 ACCESSORIES

- A. Wall Seals:
 - 1. Provide a hydrostatic seal to fill the annular space between conduit and through structure openings.
 - 2. Manufacturer:
 - a. PSI-ThunderLine/Link-Seal Corp., Link-Seal®, <u>www.linkseal.com</u>.
- B. Fire Seals:
 - 1. Where conduit penetrates fire-rated walls, floors, partitions, and ceiling, provide approved fire seals to ensure that the fire rating is maintained.
 - 2. Provide a fire seal system which is UL-listed for the application.
 - a. Provide fire seal compound or a mechanical seal for fire rating of 2 hours or less.
 - 3. Manufacturers:
 - a. Compound Fire Seals:
 - 1) Dow Corning Corporation, <u>www.dowcorning.com</u>
 - 2) 3M, http://solutions.3m.com/en_US/
 - b. Mechanical Fire Seals:
 - 1) PSI-ThunderLine/Link-Seal Corp., <u>www.linkseal.com</u>
 - c. Through-Wall Barrier Fire Seals:
 - 1) Cooper Crouse-Hinds, http://crouse-hinds.com

2.04 FABRICATION

A. Fit and shop assemble items in the largest sections practical for delivery to the Site.

2.05 FINISHES

- A. Prime paint non-galvanized steel items.
 - 1. Prepare surfaces to be primed in accordance with the requirements of SSPC-SP 2.
 - a. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
 - 2. Prime Painting: Apply one coat of primer.
- B. Galvanizing items specified above as galvanized.
 - 1. Galvanize the items after fabrication in accordance with the requirements of ASTM A 123/A 123M.
 - 2. Provide a minimum galvanized coating of 1.25 ounces per square foott (380 grams per square meter).
- C. Touch-Up Primer:
 - 1. For un-galvanized metal surfaces: Provide primer complying with the requirements of SSPC-Paint 15 for Type I, Red Iron Oxide.
 - 2. For galvanized surfaces: Provide primer complying with the requirements of SSPC-Paint 20 for Type I, Inorganic Zinc-Rich Primer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field Measurement:

- 1. Although the Contract Drawings are generally indicative of the Work, take field measurements to verify actual conditions.
 - a. Due to the small scale of the Contract Drawings it is not possible to indicate all offsets, fittings, and apparatus required or the minor structural obstructions that may be encountered during the Work.
- 2. Carefully investigate the structural and finish conditions, and other construction work, at the Site which may affect the work of this Section.

3.02 PREPARATION

- A. After carefully investigating structural and finish conditions and other in-place construction work, produce detailed Shop Drawings showing proposed departures from the original design due to field conditions or other causes.
 - 1. Layout the electrical work according to accepted standard electrical trade practice to suit actual field measurements.
 - 2. Arrange the electrical work to consider existing conditions and to preserve access to other equipment, rooms, areas, and similar features of the construction.
 - 3. Show equipment backboards and support structures not directly fastened to the walls on the Shop Drawings.
 - 4. Indicate the location and details of conflicting utility construction and slopes on the Shop Drawings.
 - 5. Submit the Shop Drawings to the Engineer for approval prior to performing the Work of this Section.
- B. Obtain roughing-in dimensions of electrically operated equipment, including equipment being installed by both electrical and other construction trades.
 - 1. Set conduit and boxes only after receiving approved dimensions and checking such equipment locations.
 - 2. Arrange electrical Work accordingly and furnish such fittings and apparatus as required to accommodate such conditions and to preserve access to other equipment, rooms, areas, and similar spaces.

3.03 INSTALLATION

- A. Install electrical Work in conformance to the requirements of NFPA 70 for wiring methods general requirements, and to other applicable Articles of the NEC governing methods of wiring.
- B. Installing Anchors and Fasteners:
 - 1. For anchoring or fastening applications in masonry and hollow-core precast concrete structural elements, provide masonry anchors as specified herein.
 - 2. For anchoring or fastening applications in cast-in-place concrete and solid precast concrete structural elements, provide concrete anchors as specified herein.
 - 3. Threaded Bolts:
 - a. Draw threaded bolted connections up tight using 316 stainless steel lock washers to prevent the bolt or nut from loosening.
 - 4. Drilled-In Expansion Anchors:
 - a. Install expansion anchors in strict accordance with manufacturer's instructions and the following.

- 1) Drill holes to the required diameter and depth in accordance with anchor manufacturer's instructions for the size of anchor being installed.
- 2) Minimum Embedment:
 - a) Embed expansion anchors to four and one-half bolt diameters minimum unless otherwise indicated on the Contract Drawings.
- C. Installation of U-Channel Support Framing Systems: per Table 26 0528-1 below:

Table 26 0528-1 U-Channel Support Framing Selection		
Condition 1	Condition 2	Туре
Aboveground	Interior Dry Locations	Carbon steel
	Interior, Sub-Basement	PVC-Coated steel

- D. Installing Conduit Supports:
 - 1. For interior locations, provide stamped steel conduit supports.
- E. Panelboard/Enclosure Feed Risers:
 - 1. Furnish and install cable supports in feeder risers as required by the underwriters.
- F. In areas designated as wet, NEMA 3, NEMA 3R, NEMA 4X, NEMA 12, or NEMA 13 as defined in NEMA 250; and in the Sub-Basement of the building; conform work to the following:
 - Secure equipment and conduit to no fewer than two 7/8-inch minimum depth, PVCcoated steel channels mounted vertically on the walls.
 - 2. Utilize stainless steel hardware.
- G. Field Fabrication:
 - 1. Fabricated Items:
 - a. Fabricate backboards, backboard supports, equipment supports, conduit supports, and the other items as detailed on the Contract Drawings.
 - 1) Hot-dip galvanize mild-steel fabrications in accordance with the requirements of ASTM A 153/A 153M.
 - b. Supply components required for the anchorage of fabrications.
 - 1) Except where specifically noted otherwise, fabricate anchors and related components from the same material as the fabrication and apply the same finish.
 - 2. Tightly fit and secure joints.
 - a. Make exposed joints butt tight, flush, and hairline.
 - b. Weld fabricated assemblies in accordance with AWS D1.1/D1.1M.
 - 1) Continuously seal joined members using intermittent welds and plastic filler.
 - 2) Dress welds smooth and free of sharp edges and corners.
 - c. Grind exposed joints flush and smooth with the adjacent finish surface.
 - 3. Ease exposed edges to a small uniform radius.
 - a. Cut all backboard corners to a 1-inch radius.
 - 4. For the attachment of work and for bolted connections, accurately drill or punch holes for the fasteners as required.
 - a. Burned holes are unacceptable.
 - b. Provide holes no more than 3/32-inch larger than the fasteners.
 - 5. Exposed Mechanical Fastenings:
 - a. Except where specifically noted otherwise in the Contract Documents, provide flush countersunk screws or bolts; unobtrusively located, and consistent with the design of the component.
 - 6. Fabrication Tolerances:
 - a. Squareness: 1/8 inch (3 mm), maximum difference in diagonal measurements.
 - b. Maximum offset between faces: 1/16 inch (1.5 mm).

- c. Maximum misalignment of adjacent members: 1/16 inch (1.5 mm).
- d. Maximum bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- e. Maximum deviation from plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

3.04 REPAIR/RESTORATION

- A. Coatings:
 - 1. Repair damage to coatings.
 - a. Touch up damaged coating surfaces, using the specified primer for primed steel surfaces, and using zinc-rich primer for galvanized steel surfaces.

3.05 FIELD QUALITY CONTROL

- A. Inspection:
 - 1. Verify the adequacy of coatings.
 - 2. Inspect the items provided under this Section for adherence to the fabrication tolerances specified above, and correct any discrepancies:

3.06 PROTECTION

A. Protect the items provided under this Section from damage during the work of other trades.

END OF SECTION 20 0528

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SECTION 26 0533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:1. Division 26 Section "Wiring Devices" for devices installed in boxes.

1.03 DEFINITIONS

- A. FMC: Flexible metal conduit.
- B. RGS: Rigid galvanized steel conduit.
- C. LFMC: Liquidtight flexible metal conduit.

1.04 SUBMITTALS

- A. Product Data: For raceways and fittings, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.
- 1.05 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.

1.06 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
- 2.02 METAL CONDUIT AND TUBING
 - A. Available Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Anamet Electrical, Inc.; Anaconda Metal Hose
 - 4. Electri-Flex Co.
 - 5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
 - 6. LTV Steel Tubular Products Company
 - 7. Manhattan/CDT/Cole-Flex
 - 8. O-Z Gedney; Unit of General Signal
 - 9. Wheatland Tube Co.
 - 10. Or Approved Equal
 - B. Rigid Galvanized Steel Conduit: ANSI C80.1.
 - C. FMC: Zinc-coated steel.
 - D. LFMC: Flexible steel conduit with PVC jacket.
 - E. Fittings: NEMA FB 1; compatible with conduit and tubing materials.
- 2.03 BOXES, ENCLOSURES, AND CABINETS
 - A. Available Manufacturers:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. Emerson/General Signal; Appleton Electric Company
 - 3. Erickson Electrical Equipment Co.
 - 4. Hoffman
 - 5. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - 6. O-Z/Gedney; Unit of General Signal
 - 7. RACO; Division of Hubbell, Inc.
 - 8. Robroy Industries, Inc.; Enclosure Division
 - 9. Scott Fetzer Co.; Adalet-PLM Division
 - 10. Spring City Electrical Manufacturing Co.
 - 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, Type FD, with gasketed cover.
 - D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
 - E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
 - F. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include

metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.04 FACTORY FINISHES

A. Finish: For surface raceway, wireway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

- A. Indoors: 1. Ex
 - Exposed: Rigid galvanized steel.
 - a. All feeder conduits shall be RGS.
 - Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations, including the Boiler room and Sub-Basement.
 - 3. Damp or Wet Locations: Rigid galvanized steel conduit.
 - 4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 3R.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid Galvanized Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
- 3.02 INSTALLATION
 - A. 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.
 - B. Complete raceway installation before starting conductor installation.
 - C. Install temporary closures to prevent foreign matter from entering raceways.
 - D. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
 - E. Make bends and offsets so inside diameter is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
 - F. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
 - G. Join raceways with fittings designed and approved for that purpose and make joints tight.
 1. Use insulating bushings to protect conductors.
 - H. Tighten set screws of threadless fittings with suitable tools.

- I. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- 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. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- L. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations, including the Boiler room and Sub-Basement. Install separate ground conductor across flexible connections.
- M. Grounding Conductors in Raceways: Install a separate, green, ground conductor in all raceways.
- N. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- O. Fire stopping: Use UL listed materials as shown in a UL listed detail for the configuration of the penetration. Submit UL detail showing materials used.

3.03 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 paint finishes with matching touchup coating recommended by manufacturer.

3.04 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 26 0533

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceways
 - 2. Identification for conductors and control cable
 - 3. Warning labels and signs
 - 4. Equipment identification labels/signs
 - 5. Miscellaneous identification products
- B. The extent of electrical identification is indicated by drawings.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications and installation instructions for each identification material and device required. Include data substantiating that materials comply with requirements.
- 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.
- 1.04 QUALITY ASSURANCE
 - A. Comply with ANSI A13.1 and ANSI C2.
 - B. Comply with NFPA 70.
 - C. Comply with 29 CFR 1910.145.
 - D. UL Compliance: Comply with applicable portions of UL safety standards pertaining to electrical marking and labeling identification systems.
 - E. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.
- 1.05 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

2.01 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Almetek Industries, Inc.
 - 2. W.H. Brady Co.
 - 3. Cole-Flex Corp.
 - 4. Griffolyn Co.
 - 5. Ideal Industries, Inc.
 - 6. LEM Products, Inc.
 - 7. National Band and Tag Co.
 - 8. Radar Engineers Div., EPIC Corp.
 - 9. Seton Nameplate Co.
 - 10. Tesa Corp.

2.02 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.
- B. Cable/Conductor Identification Bands: Provide manufacturer's standard aluminum wrap-around cable/conductor markers, of size required for proper application, and numbered to show circuit identification, or provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; either pre-numbered, plastic-coated type or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.
- C. Plasticized Tags: Provide manufacturer's standard pre-printed or partially pre-printed accidentprevention and operational tags, of plasticized card stock with matte finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples: DANGER, CAUTION, DO NOT OPERATE).
- D. Self-Adhesive Plastic Signs: Provide manufacturer's standard, self-adhesive or pressuresensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application (as examples: 208 VOLTS, EXHAUST FAN, RECTIFIER). Unless otherwise indicated or required by governing regulations, provide orange signs with black lettering.
- E. Engraved Plastic-Laminate Signs: Provide engraving stock melamine plastic laminate signs, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black and white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

- F. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.
- G. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.03 LETTERING AND GRAPHICS:

- A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.
- 2.04 WARNING LABELS AND SIGNS
 - A. Comply with NFPA 70 and 29 CFR 1910.145.
 - B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
 - C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING OSHA REGULATION AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.05 ARC FLASH WARNING LABELS

- A. Arc Flash Warning Labels shall be prepared in accordance with NFPA 70, NFPA 70E, IEEE-1584 latest editions and ANSI Z535.
 - 1. Minimum label size shall be 4" x 6" as provided by Duralabel or Brady with applicable header information identifying both warning and danger based upon the findings.
 - 2. Minimum information to be included on the Arc Flash label shall consist of the following:
 - a. Prefaced electrical warning including universal symbol identification, approved safety color, and preface description noting that arc and shock hazard are present. Note where dual labeling is provided/required with the use of arc flash reduction maintenance settings within the equipment, such labels shall be uniquely identified by a different label safety color I, as approved by the Owner. Consult the Owner for acceptable color schemes to be used for the equipment.
 - b. Statement noting that personnel protective equipment (PPE) requirements are required. Also clearly identify all equipment as "Dangerous" where work on energized equipment is otherwise prohibited and/or where no safe PPE protection so exists.
 - c. Calculated arc flash hazard boundary, in inches.
 - d. Calculated arc flash hazard at 18 inches, in calories/cm².
 - e. Arc flash hazard risk category, including descriptive summary of required PPE items necessary for entry into energized equipment.
 - f. Voltage classification and description of conditions present for shock hazard.
 - g. Insulated glove classification rating, as required for contact conditions and measurements.
 - h. Limited approach boundary, in inches.
 - i. Restricted approach boundary, in inches.
 - j. Prohibited approach boundary, in inches.
 - k. Available short circuit current.

- I. Unique equipment locator identification, corresponding to applicable device abbreviation identifiers utilized for the electrical system study / one-line diagram prepared by Contractor as specified in Section 26 0500.
- m. Name, address & phone number of the responsible engineer, engineering company or agency contracted to perform the analysis. Also include the preparer's name, where prepared by a subcontract to the named company or agency contracted to perform the analysis report.
- n. Respective contract (job) number for the analysis report.
- o. Preparation date of the issued/approved Arc Flash Study (analysis) supporting the equipment labeling, as installed.
- p. Suffix cautionary warning that "Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements."

2.06 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.

2.07 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- B. 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.

2.08 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. 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

3.01 APPLICATION

- A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways, Over 600 Volts: Identify the voltage carried in conduit or raceway by providing voltage labeling markers on all accessible raceways, or by other means as approved or directed by the School District.
- C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands: Revise list below to suit Project.
- 1. Control Wiring: Green and red.
- D. 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.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- 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, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Adhesive film label with clear protective overlay. 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. Unit Substations
 - b. Switchboards, panelboards, electrical cabinets, and enclosures
 - c. Access doors and panels for concealed electrical items
 - d. Emergency system boxes and enclosures
 - e. Disconnect switches
 - f. Enclosed circuit breakers
 - g. Motor starters
 - h. Push-button stations
 - i. Contactors
 - H. Arc Flash Warning Labels: For each arc location or circuit analyzed as part of the Arc Flash Study required by Section 26 0500, furnish and install an Arc Flash Warning label.

3.02 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 nonadhesive 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 service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black
 - b. Phase B: Red
 - c. Phase C: Blue
- H. Color-Coding for Phase and Voltage Level Identification, Over 600 Volts: Conform to requirements of the Local Electric Utility Company.
- I. Painted Identification: Prepare surface and apply paint according to Division 09, "Painting" Section(s).

END OF SECTION 26 0553

SECTION 26 0563

ACCEPTANCE ELECTRICAL TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of materials to performance test electrical systems and equipment.
 - 1. Items Supplied Under This Section:
 - a. Electrical System Testing
 - b. Thermographic Testing
 - c. Ground System Testing
 - d. Equipment Testing
 - e. Test Procedure
 - f. Test Report
- B. Related Sections:
 - 1. Division 01 General Requirements
 - 2. Division 26 Sections, As Applicable

1.02 REFERENCES

- A. Applicable Documents and Testing Requirements of:
 - America National Standards Institute (ANSI): as applicable, including:
 - a. ANSI C2 National Electrical Safety Code
 - b. ANSI Z244.1 American National Standards for Personnel Protection.
 - 2. National Electrical Manufacturer's Association (NEMA): as applicable, including:
 - a. NEMA PB 1.1 General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
 - b. NEMA PB 2.1 Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
 - 3. American Society for Testing and Materials (ASTM), as applicable.
 - 4. Institute of Electrical and Electronics Engineers (IEEE), as applicable.
 - 5. National Fire Protection Association (NFPA), as applicable, including:
 - a. NFPA 70 National Electrical Code (NEC)
 - b. NFPA 70E Electrical Safety Requirements for Employee Workplaces.
 - 6. Insulated Cable Engineer's Association (ICEA), as applicable.
 - 7. State and Local Codes and Ordinances as applicable.
 - Occupational Safety and Health Administration (OSHA), as applicable, including:
 a. Title 29 Parts 1907, 1910 and 1936.
 - 9. InterNational Electrical Testing Association (NETA) as applicable, including:
 - a. ATS-2017 Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems
 - b. MTS-2015 Maintenance Testing Specifications for Electric Power Distribution Equipment and Systems.

1.03 SUBMITTALS

- A. Submit documentation as required by this Section of the Contract to the Design Engineer in strict accordance with the provisions of Section 26 05 00 for review, comments and subsequent approval.
- B. Submission to include the following:
 - 1. Field inspection report as required for each item of material and/or equipment outlined herein.
- C. Test Reports:
 - Each test report prepared by the respective testing firm(s) comply, where applicable, to all stipulations specified in Section 26 0500 for Operation, Maintenance and Installation Manuals with reference to preparation, paper requirements, indexing and binders. Include in each test report the following:
 - a. Summary of project
 - b. Description of equipment tested
 - c. Description of test
 - d. Test results
 - e. Conclusions and recommendations
 - f. Appendix, including appropriate test forms
 - g. Identification of test equipment used
 - h. Signature of responsible test organization authority
 - i. Furnish five copies of each completed report to the Design Electrical Engineer no later than 30 days after completion of each test. Assemble and certify the testing firm each final test report, which must be submitted to the Design Engineer for review, comments and subsequent approval.

1.04 QUALITY ASSURANCE

- A. Qualifications of Testing Laboratory: Select an independent nationally recognized testing laboratory that is independent from electrical contractor that either is a member of The International Electrical Testing Association or meets the following qualifications:
 - 1. Is nationally recognized as an electrical testing laboratory.
 - 2. Has been regularly engaged in the testing of electrical systems and equipment for at least 2 years.
 - 3. Is independent from the electrical contractor, the Owner, the Engineer and all other contractors on the job.
 - 4. Has at least one Professional Engineer on staff that is licensed in the State where the project site is located.
 - 5. Derives more than 75 percent of its income from electrical testing.
 - 6. Owns or leases sufficient calibrated equipment to do the testing required.
 - 7. Has a means to trace all test instrument calibration to The National Institute of Standards and Technology.
- B. Membership in the International Electrical Testing Association (NETA) shall be considered evidence of meeting items A. 1. through and including A. 5
- C. Testing shall be done under the supervision of a technician certified by International Electrical Testing Association or by technicians that are both certified by the National Society of Professional Engineers and experienced in electrical testing with 5 years of testing experience.
- D. The testing laboratory shall supervise or perform all testing of equipment and oversee setting of all circuit breakers and calibration of all instruments.

- E. The testing firm used must be approved by the Engineer.
- F. Include the cost of such tests in the Contractors Bid Price for the applicable bid item.

1.05 GENERAL REQUIREMENTS

- A. Field Inspection:
 - 1. This Contractor is responsible for a complete inspection of all equipment, prior to testing and energizing to ascertain that it is free from any damage, scratches, or missing components and that all power connections are correct, and that they are tight in conformance with recommended standard practice. The inspection is to also include a check of control wiring, terminal connections and all bolts and nuts.
 - 2. Perform field inspection by this Contractor during a time when the Field Engineer and the Design Engineer are present to witness each inspection and its performance.
 - 3. Correct any deficiencies found during the inspection by this Contractor prior to the energizing and testing of the equipment.

1.06 SCHEDULING

A. Schedule all testing with work of other contractors to ensure an orderly sequence of startup and completion of work.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 ELECTRICAL INSPECTIONS AND TESTS

- A. Perform, supervise, and furnish all test equipment needed to perform tests and provide safety measures, procedures and equipment required for each test.
- B. Schedule all testing with the Construction Manager (CM). Perform testing in the presence of the CM, except when the CM approves in writing the conducting of a specific test without being present.
- C. Notify all involved parties including the Construction Manager prior to tests, advising them of the test to be performed and the scheduled date and time.
- D. Coordinate the tests with others involved.
- E. Prepare written test procedures and forms used in the test reports and submit for approval prior to commencement of testing.
- F. Include in each test report the following information:
 - 1. Job title
 - 2. Date of test
 - 3. Equipment, system or cable identification
 - 4. Type of test
 - 5. Description of test instrument and date of latest calibration
 - 6. Section of specification defining test along with description of test and evaluations as reported by the testing company

- 7. Test results (correct all readings at 20 degrees C)
- 8. Signature of person supervising test
- Signature of Contractor 9.
- 10. Space for Construction Manager's signature.
- G. Refer to individual tests and inspections hereinafter specified for any additional or specified requirements.
- н Test Instrument Calibration:
 - The testing firm is to have a calibration program, which assures that all applicable test 1 instrumentation are maintained within rated accuracy.
 - The accuracy is to be directly traceable to The National Institute of Standards and 2. Technology.
 - 3. Instruments are to be calibrated in accordance with the following frequency schedule. a. Field Instruments:
 - Analog 6 months maximum
 - Digital 12 months maximum
 - 12 months b. Laboratory Instruments: Leased specialty equipment: 12 months C.
 - Make dated calibration labels visible on all test equipment. 4.
 - Keep records up-to-date, which show date and results of instruments calibrated or tested. 5.
 - 6. Maintain an up-to-date instrument calibration instruction and procedure for each test instrument.
 - 7. Calibrating standard is to be of higher accuracy than that of the instrument tested.
- Safety and Precautions: Ι.
 - Safety practices are to include, but are not limited to, the following requirements: 1
 - Occupational Safety and Health Act of 1970-OSHA a.
 - b. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4
 - Applicable State and Local safety operating procedures C.
 - IETA Safety/Accident Prevention Program d.
 - Owner's safety practices e.
 - National Fire Protection Association NFPA 70E f.
 - g. ANSI Z244.1 American National Standards for Personnel Protection
 - 2. Perform all tests with apparatus de-energized except where otherwise specifically required.
 - The testing firm is to have a designated safety representative on the project to supervise 3. all testing operations with respect to safety.

3.02 TESTING TO BE PERFORMED BY CONTRACTOR

- The Contractor is required to obtain copies of NETA ATS-2017 and MTS-2015, and to keep at Α. least one copy of each at the project site, to use as reference for testing requirements.
- B. Continuity Test: Make test for continuity and correctness of wiring and identification on all conductors installed.
- C. Wire and Cable:
 - Test all wires and cables sized No. 2 and larger in accordance with NETA ATS-2017. 1.
 - Perform visual, mechanical, and electrical tests on all No. 4 and No. 6 power cables that 2. operate at voltages exceeding 150 volts to ground in accordance with NETA ATS-2017.

- 3. Perform visual, mechanical, and electrical tests on all other wires and cables in accordance with NETA ATS-2017.
- 4. Replace any wires which have been damaged.
- 5. Correct causes of all readings which do not meet the acceptable minimum insulation readings are as stated in NETA ATS-2017. Exceed the nominal expected temperatures for the actual load.
- 6. Retest items requiring correction.
- D. Surge Protective Devices (SPDs):
 - 1. Visually and mechanically inspect the SPD unit and connections.
 - 2. Use an AC voltmeter to check all voltages and ensure that normal operating voltages of the power system match the voltage rating on the SPD nameplate.
 - 3. Check LED status indicators on the display panels and suppression modules to confirm normal status.
 - 4. Press the alarm test button to confirm the audible alarm and LED.
 - 5. Operate the alarm silence switch to confirm proper operation.
- E. Ground Fault Circuit Interrupter (GFCI) Receptacles:
 - 1. Test all GFCI receptacles as specified in Section 26 2726.
- F. Lighting Tests:
 - Emergency, standby, equipment and lighting test-trip all incoming utility power and ascertain that all standby and emergency equipment operates. Replace and correct defective equipment. Operate battery systems for emergency lighting without power for 90 minutes and correct all defects and retest.

3.03 TESTING TO BE PERFORMED BY THE TESTING LABORATORY

- A. The Contractor shall select, hire and pay an independent, nationally recognized electrical testing laboratory to perform all testing specified in this Article. Obtain Owner's approval of the testing laboratory and the testing laboratory's proposed test procedure prior to commencement of any tests.
- B. Set all adjustments for all overcurrent protection devices in accordance with the protection and coordination study required by Section 26 0500.
- C. Visually and mechanically inspect and electrically test items of equipment (as listed and required hereinafter) using the procedures of NETA ATS-2017. When a test for a particular item is not called out in ATS, test using the procedures in NETA MTS-2015.
- D. Thermographic Inspection:
 - 1. Perform thermographic inspection of the electrical equipment and installations, provided under this Project and as listed below, in accordance with NETA ATS-2017, and these Specifications. The following equipment is to be scanned:
 - a. Switchboards:
 - b. Switchgear:
 - c. Service Entrance Equipment:
 - d. Lighting Panelboards:
 - e. Power Panelboards:
 - f. Dry Type Transformers:
 - g. Individually Mounted Circuit Breakers:
 - h. Disconnect Switches:
 - i. Elevator Shunt-Trip Fused Disconnect Switches:
 - j. Individually Mounted Motor Starters Size:

all ratings all ratings all ratings all ratings 50-Ampere and larger 10 kVA and larger 100 amp and larger 100 amp and larger

all ratings Size 1 and larger k. Motors:

30 HP and larger

- 2. Provide report including the following items:
 - a. Items scanned
 - b. Whether item passed or failed
 - c. All items in NETA ATS-2017
 - d. The probable cause
 - e. Severity of defect
 - f. Recommended corrective measures
 - g. Video recording of test.
- 3. Scan using an infrared camera with video scanner output to a display screen with a range of at least 1 degree C to 75 degrees C with an accuracy of 0.1 degree C and with the following equipment:
 - a. One 7 degree telephoto lens
 - b. One 20 degree wide angle lens
 - c. One 40 degree extra-wide angle lens
- 4. Record output of camera during testing onto a DVD or store digital images of each piece of equipment inspected onto a CD as a record of the temperature variations. Record either by order or by digital imprinting the actual equipment being scanned. Turn off recordings during inactive periods or edit DVD to eliminate dead periods.
- 5. Display data on a monitor capable of providing both a gray step mode and color monitor. These capabilities allow distinct temperature levels to be shown in black and white and color on the thermogram.
- 6. Submit three copies of report and two copies of the DVD or CD.
- 7. Include DVD or CD of thermographs of the defective equipment and installations. Also include in report.
- 8. Submit both copies of the report to the Engineer who will make the determination of corrective measurements.
- E. Medium Voltage Switch/Switchgear Tests:
 - 1. Visually and mechanically inspect and electrically test all medium voltage switchgear, in accordance with NETA ATS-2017.
 - 2. Acceptable values are as stated in NETA ATS-2017.
 - 3. Test all components as specified in this Section.
- F. Liquid Filled Transformer Tests:
 - 1. Visually and mechanically inspect and electrically test liquid filled transformers in accordance with NETA ATS-2017.
 - 2. Acceptable values are as stated in NETA ATS-2017.
- G. Low Voltage Molded Case Circuit Breaker Tests:
 - 1. Visually and mechanically inspect and electrically test all low voltage circuit breakers in frame sizes rated 100-amperes or more in accordance with NETA ATS-2017.
 - 2. Acceptable values are as stated in NETA ATS-2017.
- H. Low Voltage Switchboard Tests:
 - 1. Visually and mechanically inspect and electrically test all low voltage switchboards in accordance with NETA ATS-2017.
 - 2. Acceptable values are as stated in NETA ATS-2017.
 - 3. Test all switchboard components as specified in this Section.
- I. Low Voltage Panelboard Tests:

- 1. Visually and mechanically inspect and electrically test all low voltage panelboards furnished under this Project in accordance with NETA ATS-2017.
- 2. Acceptable values are as stated in NETA ATS-2017.
- 3. Test all components as specified in this Section.
- J. Dry Type Transformer Tests:
 - 1. Visually and mechanically inspect and electrically test low voltage dry-type transformers in accordance with NETA ATS-2017.
 - 2. Acceptable test values are as stated in NETA ATS-2017.
- K. Low Voltage Motor Starter Tests:
 - 1. Visually and mechanically inspect and electrically test all low voltage motor starters, furnished under this Project and rated 10-horsepower or more, in accordance with NETA ATS-2017.
 - 2. Acceptable values are as stated in NETA ATS-2017.
- L. AC Motor Testing:
 - 1. Visually and mechanically inspect and electrically test all AC motors rated 10-horsepower or more in accordance with NETA ATS-2017.
 - 2. Acceptable test values are as stated in NETA ATS-2017.
 - 3. Immediately report all motors, which fail inspection to the Engineer for correction.
- M. Voltage Adjustment:
 - Measure the voltage at both no load and at nominal load at the following locations.
 a. Main Distribution Switchboard.
 - 2. Adjust the transformer taps to bring the no-load voltage above nominal, but in no case, higher than 105.8% of nominal.
 - 3. Adjust the operated loaded voltage to a value above 91.7%, (ANSI Range A), with only momentary excursions to a maximum of 105.8% and a minimum of 88.3% for all loads and 86.7% for motor loads. (ANSI Range B).
 - 4. After all adjustments have been made, re-measure all voltages.
 - 5. For record purposes, measure and record on all 3-phases the actual load at the switchboard.
 - a. Measure minimum/maximum/average voltage, current and kVA load at the Main Distribution Switchboard over a 24 hour period with a recording meter.

3.04 CORRECTION OF DEFICIENCIES

- A. Report all unacceptable values immediately. Correct all deficiencies found in work of this contract and separately report deficiencies in work of items of other contracts.
 - 1. Retest items requiring correction. Correct or have corrected any remaining deficiencies and retest until work is acceptable.

3.05 RETESTING

- A. After equipment has been in service for a period of nine months repeat the following tests:
 - 1. Thermographic testing. Correct all causes of readings above the nominal expected reading for the load encountered.

END OF SECTION 26 0563

SECTION 26 2416

PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:1. Lighting and appliance branch-circuit panelboards.

1.03 SUBMITTALS

- A. Product Data: For each type of panelboard, 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. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1
 - b. Bus configuration, current, and voltage ratings
 - c. Short-circuit current rating of panelboards and overcurrent protective devices
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports including the following:
 - 1. Test procedures used
 - 2. Test results that comply with requirements
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "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.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Section "Products."
- D. 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.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not exceeding 122 deg F (50 deg C)
 - 2. 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. Outages shall be scheduled to occur over the summer months when school is not in session; outages during the normal school year shall not be permitted.
 - 2. Notify Construction Manager/Owner no fewer than fourteen (14) days in advance of proposed interruption of electrical service
 - 3. Do not proceed with interruption of electrical service without Construction Manager's/Owner's written permission.

1.06 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, and encumbrances to workspace clearance requirements.

1.07 EXTRA MATERIALS

- 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. Keys: Four (4) spares for each type of panelboard cabinet lock
 - a. All panelboards furnished under this Project shall be keyed alike, using Corbin lock as basis of design as specified hereinafter.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products
 - b. Siemens Energy & Automation, Inc.
 - c. Square D Company.

2.02 MANUFACTURED UNITS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.
- B. Enclosures: Flush- and surface-mounted cabinets; NEMA PB 1, Type 1 or as otherwise required.
 - 1. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover
 - 3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat
 - 4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- C. Phase and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material.
 - 1. Main and Neutral Lugs: Compression type
 - 2. Ground Lugs and Bus Configured Terminators: Compression type.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- 2.03 PANELBOARD SHORT-CIRCUIT RATING
 - A. Fully rated to interrupt symmetrical short-circuit current available at terminals.
- 2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS
 - A. Main Overcurrent Protective Devices (where required): Circuit breaker, thermal-magnetic type or as indicated on the Drawings.
 - B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, thermal-magnetic type; replaceable without disturbing adjacent units.
 - C. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike using Corbin lock as basis of design.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with series-connected rating 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.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - 2. Application Listing: Appropriate for application; Type HACR for heating, air-conditioning, and refrigerating equipment.
- C. Circuit breakers for installation in existing switchboards shall match make and model of existing.

2.06 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 74 inches above finished floor, unless otherwise indicated or required.
- C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Install overcurrent protective devices.1. Set field-adjustable circuit-breaker trip ranges, as applicable.
- 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.
- 3.02 IDENTIFICATION
 - A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 26 053.
 - B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- 3.03 CONNECTIONS
 - A. Ground equipment according to Section 26 0526.
 - B. Connect wiring according to Section 26 0519.
- 3.04 FIELD QUALITY CONTROL
 - A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
 - B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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.
 - C. 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.

3.05 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 2416

NORTHEAST HIGH SCHOOL – AIR CONDITIONING UNITS SDP CONTRACT NO. B-001c, B-002c, B-003c and B-004c of 2020/2021

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SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

- 1.01 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- 1.02 SUMMARY
 - A. This Section includes the following:
 - 1. Duplex receptacles.
 - 2. Ground-fault circuit interrupter duplex receptacles.
 - 3. Light switches.
 - 4. Device wall plates.
- 1.03 DEFINITIONS
 - A. GFCI: Ground-fault circuit interrupter.
- 1.04 SUBMITTALS
 - A. Product Data: For each type of product indicated.
 - B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
 - C. Field quality-control test reports.
- 1.05 QUALITY ASSURANCE
 - A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
 - 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.
- 1.06 COORDINATION
 - A. Receptacles and/or Cord and Plug Sets for Equipment Connections: Match requirements of the actual equipment installed, regardless of type indicated on project Bid Documents.
 - 1. Obtain copies of final or "Approved" equipment Shop Drawings from equipment suppliers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Wiring Devices:
 - a. Hubbell / Bryant Electric
 - b. Hubbell Wiring Device-Kellems
 - c. Legrand / Pass & Seymour
 - d. Or Approved Equal

2.02 RECEPTACLES

- A. Straight-Blade Receptacles: Provide heavy-duty duplex receptacles, 2-pole, 3-wire grounding type, 20-amperes,125-volts, with metal plaster ears, back wiring, NEMA configuration 5-20R, unless otherwise indicated or required.
- B. GFCI Receptacles: Provide 20-amperes, 125-volt, 2-pole, 3-wire grounding type, Hospital grade, with integral straight-blade NEMA configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a standard 2-1/2-inch- deep outlet box without an adapter.
- 2.03 LIGHT SWITCHES
 - A. Snap Switches: Provide heavy-duty grade, quiet type, flush single or double pole, three-way or four-way switches as indicated on the drawings; 20 amperes, 125 volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, switch handle, and side wired screw terminals.
- 2.04 WALL PLATES
 - A. Single and combination types to match corresponding wiring devices.
 - 1. Material: 0.035-inch- thick, satin-finished stainless steel.
 - 2. Provide red faceplates for emergency shutoff switches or devices.

2.05 FINISHES

- A. Color:
 - 1. Wiring Devices Connected to Normal Power System: Brown or other color as selected by Architect, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

- 3.01 INSTALLATION
 - A. Install devices and assemblies level, plumb, and square with building lines.
 - B. 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.
 - C. Remove wall plates and protect devices and assemblies during painting.

3.02 IDENTIFICATION

- A. Comply with requirements of Section 26 0553.
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate; and durable wire markers or tags inside outlet boxes.
- 3.03 CONNECTIONS
 - A. Ground equipment according to Section 26 0526.
 - B. Connect wiring according to Section 26 0519.
 - C. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- 3.04 FIELD QUALITY CONTROL
 - A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
 - B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 26 2726

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VALLEY FORGE, PA 19403



THE SCHOOL DISTRICT OF ADEL PH **NORTHEAST HIGH SCHOOL** 1601 COTTMAN AVE, PHILADELPHIA, PA 19104 NORTHEAST HIGH SCHOOL AIR CONDITIONING UPGRADE

GENERAL NOTES:

- THE CONTRACTOR SHALL BECOME FAMILIAR WITH THE EXISTING CONDITIONS AFFECTING THIS PROJECT AND COORDINATE WITH OTHER DISCIPLINES.
- THE WORK IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS SHALL CONSIST OF PROVIDING ALL EQUIPMENT, MATERIALS, LABOR, SERVICES AND PERFORMED IN COMPLIANCE WITH THE APPLICABLE CODES AND STANDARDS.
- 3. ALL EQUIPMENT SHALL BE HANDLED, STORED, AND PROTECTED TO PREVENT DAMAGE BEFORE AND DURING INSTALLATION IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
- 4. ALL EQUIPMENT SHALL BE INSTALLED AND ADEQUATE CLEARANCES BE PROVIDED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND CODE.
- ALL NEW EQUIPMENT SHALL BE TESTED IN ACCORDANCE WITH APPLICABLE CODES AND STANDARDS. LEAKS, IF ANY, SHALL BE REPAIRED AND THE PIPING SHALL BE RETESTED TO MEET THE REQUIREMENTS.
- 6. ALL NEW EQUIPMENT IS SHOWN IN APPROXIMATE POSITION. THE CONTRACTOR SHALL FIELD VERIFY THE ROUTING AND TIE-INS OF NEW AND EXISTING PIPING. ALL NEW PIPING SHALL BE INSTALLED AND ADEQUATELY SUPPORTED IN ACCORDANCE WITH APPLICABLE CODES AND STANDARDS.
- THE CONTRACTOR SHALL CHECK AND FIELD VERIFY ALL CONDITIONS AND DIMENSIONS AT THE SITE PRIOR TO SUBMITTING BID AND BEFORE START OF CONSTRUCTION.
- THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING INSTALLATION OF ALL EQUIPMENT SHOWN ON THE DRAWINGS, INCLUDING COORDINATION IF ANY EQUIPMENT OF ALTERNATE MANUFACTURER. THE CONTRACTOR SHALL PROVIDE COMPOSITE DRAWINGS AS REQUIRED FOR THE INSTALLATION OF EQUIPMENT AS SHOWN ON PLAN FOR APPROVAL BY ENGINEER.
- 9. ANY EQUIPMENT, MATERIALS, LABOR OR SERVICES NOT SPECIFICALLY MENTIONED HEREIN WHICH MAY BE NECESSARY TO COMPLETE OR PERFECT ANY PART OF INSTALLATION IN A SUBSTANTIAL MANNER SHALL BE FURNISHED WITHOUT EXTRA COST TO THE OWNER.
- 10. ALL WORK SHALL COMPLY WITH LOCAL AND NATIONAL CODES AND STANDARDS, UNDERWRITERS LABORATORY APPROVAL, AND ALL STATE AND FEDERAL OSHA SAFETY REQUIREMENTS. 11. THE MECHANICAL CONTRACTOR SHALL PAINT ALL UN-INSULATED METAL
- PIPING, IRON OR STEEL VALVES, AND ALL SUPPORTS AS INDICATED IN SPECIFICATIONS. THE MECHANICAL CONTRACTOR SHALL PRIME PAINT ALL METAL PIPING AND VALVES PRIOR TO INSULATION APPLICATION. THE GENERAL CONTRACTOR SHALL PAINT ALL EQUIPMENT FOUNDATIONS. WALLS, AND CEILINGS AS INDICATED IN SPECIFICATIONS.
- 12. NEW COOLING CONDENSATE PIPING SHALL BE TYPE 'K' COPPER WITH SOLDERED JOINTS OR THREADED CARBON STEEL SCHEDULE 40. REFRIGERANT SUCTION AND REFRIGERANT LIQUID PIPING SHALL BE ACR COPPER PIPING.
- 13. LOCAL CODES SHALL SUPERCEDE INTERNATIONAL BUILDING CODES WHERE CONFLICTS OCCUR.
- 14. PROVIDE DIELECTRIC UNIONS AND PROPERLY ISOLATE CONTACT BETWEEN DISSIMILAR METALS TO INHIBIT GALVANIC CORROSION.
- 15 ALL CONTRACTORS MUST SECURE AND PAY FOR EXPEDITED REVIEW OF CONSTRCTION PERMIT APPLICATIONS BY THE PHILADELPHIA DEPARTMENT OF LICENCES AND INSPECTIONS.
- 16. THE CONTRACTOR SHALL OBTAIN AND PROVIDE OWNER'S REPRESENTATIVE WITH AIR MANAGEMENT PERMIT PRIOR TO BOILER STARTUP.
- 17. THE SCHOOL DISTRICT OF PHILADELPHIA MAY RESTRICT WORK HOURS DURING THE SCHOOL DAY. 18. THE CONTRACTORS ARE RESPONSIBLE TO LABEL AND/OR PAINT ALL RESPECTIVE NEW EQUIPMENT, CONDUIT, WIRES, CONTROLS, PIPING,
- INSTRUMENTS, AND ACCESSORIES. 19. PROVIDE WELD-O-LETS FOR WELDED PIPING. "FISH-MOUTH" CONNECTIONS ARE NOT ACCEPTABLE.

APPLICABLE CODES:

1. PHILADELPHIA BUILDING CONSTRUCTION AND OCCUPANCY CODE (2018 ICC)

- SUBCODE "A": THE PHILADELPHIA ADMINISTRATIVE CODE
- SUBCODE "B": THE PHILADELPHIA BUILDING CODE
- SUBCODE "E": THE PHILADELPHIA ELECTRICAL CODE SUBCODE "EB": THE PHILADELPHIA EXISTING BUILDING CODE
- SUBCODE "EC": THE PHILADELPHIA ENERGY CONSERVATION CODE
- SUBCODE "F": THE PHILADELPHIA FIRE CODE
- SUBCODE "M": THE PHILADELPHIA MECHANICAL CODE
- SUBCODE "PC": THE PHILADELPHIA CODE FOR BUILDINGS AND MAINTENANCE
- SUBCODE "PM": THE PHILADELPHIA PROPERTY MAINTENANCE CODE
- PHILADELPHIA CROSS CONNECTION CODE
- 2018 INTERNATIONAL BUILDING CODE CHAPTER II AND APPENDIX E (ADA)
- 2. NFPA 2017 NATIONAL ELECTRIC CODE
- 3. NFPA 72-2013, NATIONAL FIRE ALARM CODE

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MECHANICAL: SDP PROJECT NO. B-006(c) OF 2020/21 ELECTRICAL: SDP PROJECT NO. B-007(c) OF 2020/21

ISSUED FOR BID : MAY 12, 2021

DEMOLITION NOTES:

- 1. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS AND TURN OFF ALL IMPACTED UTILITIES BEFORE STARTING WORK.
- 2. ALL DEMOLITION/REMOVAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE STANDARDS AND REGULATIONS.
- 3. DEMOLITION WORK SHALL BE SCHEDULED AND IMPLEMENTED WITH MINIMAL DISRUPTION TO ADJACENT OCCUPIED AREAS.
- 4. REMOVE ALL MATERIALS IN A SAFE WORKMANLIKE MANNER AND
- DISPOSE OF PER ALL APPLICABLE CODES & SAFETY REQUIREMENTS. 5. CONSTRUCTION DEBRIS MUST BE REMOVED FROM OCCUPIED SPACES AT THE END OF EACH WORK SHIFT.

SUBCONTRACTOR RESPONSIBILITIES:

- 1. THE ELECTICAL CONTRACTOR IS RESPONSIBLE FOR PROCUREMENT OF THE ENVIRONMENTAL REMEDIATION CONTRACTOR AND EXECUTION OF ALL ASBESTOS ABATEMENT, CONTAMINATED SOIL AND LEAD-BASED PAINT STABILIZATION.
- 2. SDP WILL PROCURE THE COMMISSIONING AGENT FOR THIS PROJECT. THE MECHANICAL CONTRACTOR AND ELECTICAL CONTACTOR ARE RESPONSIBLE FOR COORDINATION WITH THE COMMISSIONING AGENT AS NEEDED.

BUILDING INFORMATION

ORIGINAL CONSTRUCTION: 1957 MAJOR RENOVATIONS: 1970 - SPARC WING

> GROUND FLOOR 105,662 SF FIRST FLOOR 158,490 SF SECOND FLOOR 88,153 SF

ZONING INFORMATION

EDUCATIONAL OCCUPANCY

AREA:

CONSTRUCTION SEQUENCE PRIORITY

- CLASSROOMS - OFFICES

- OTHER SPACES

OWNER

SCHOOL DISTRICT OF PHILADELPHIA 440 N. BROAD ST. PHILADELPHIA, PA 19130-4015 PHONE: 215-400-4740 FAX: 215-400-4731 EMAIL: NWARD@PHILASD.ORG ATTN: NICOLE WARD, DESIGN MANAGER OFFICE OF CAPITAL PROGRAMS WWW.PHILASD.ORG



LOCATION MAP

ENGINEER OF RECORD

GANNETT FLEMING, INC 1010 ADAMS AVENUE VALLEY FORGE, PA 19403 PHONE: 610.650.8101 FAX: 610.650.8190 EMAIL: BWEISSER@GFNET.COM ATTN: BRIAN M. WEISSER, P.E.

> Feasterville-Trevose NORTHEAST NORTHEAST HIGH SCHOOL Delra [130] Cinnaminson Moorest Pennsauken Maple Shade Township Voorhees Township NOT TO SCALE

DRAWING LIST						
SHEET #	DRAWING #	SHEET NAME				
1	G001	PROJECT COVER SHEET				
2	M001	MECHANICAL SYMBOLS, ABBREVIATIONS, & GENERAL NOTES				
3	M101	MECHANICAL HVAC GROUND FLOOR PLAN				
4	M102	MECHANICAL HVAC FIRST FLOOR PLAN - SOUTH				
5	M103	MECHANICAL HVAC FIRST FLOOR PLAN - NORTH				
6	M104	MECHANICAL HVAC SECOND FLOOR PLAN - SOUTH				
7	M105	MECHANICAL HVAC SECOND FLOOR PLAN - NORTH				
8	M301	MECHANICAL HVAC SECTIONS				
9	M501	MECHANICAL SCHEDULES AND DETAILS				
10	M502	MECHANICAL SCHEDULES				
11	E001	ELECTRICAL SYMBOLS, ABBREVIATIONS, & GENERAL NOTES				
12	E101	ELECTRICAL POWER GROUND FLOOR				
13	E102	ELECTRICAL POWER FIRST FLOOR PLAN - SOUTH				
14	E103	ELECTRICAL POWER FIRST FLOOR PLAN - NORTH				
15	E104	ELECTRICAL POWER SECOND FLOOR PLAN - SOUTH				
16	E105	ELECTRICAL POWER SECOND FLOOR PLAN - NORTH				
17	E501	ELECTRICAL PARTIAL EXISTING SINGLE LINE DIAGRAM				
18	E502	ELECTRICAL SCHEDULES AND DETAILS				

		PITAL PROGRAMS
I	440 NORTH PHILADELPHI	I BROAD STREET A, PA 19130 - 4015
((215) 400 - 4730 wwv) (215) 400 - 4731 (fax) v.philasd.org
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PA PE	E083639	
ENG <u>MEC</u>	SINEER OF REG	CORD: . Umbing engineer:
GAN 1010 VAL	NNETT FLEMING) ADAMS AVEI LEY FORGE, P	G, INC. NUE A 19403
Phoi Emc Attn	ne: 610.783.38 ail: BWEISSER@ : BRIAN WEISS	62 GFNET.COM ER
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	1		2		3		4		5
			ABBI	REVI	ATIONS		DUCTWORK		PIPING
		@	AT			SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
		A AAV	AIR AUTOMATIC AIR VENT	ID IN WG	INSIDE DIAMETER INCHES OF WATER GAUGE				
		ABV	ABOVE AREA DRAIN, ACCESS DOOR, AIR DRYER	IN, INFO INFO	INCH, INCHES INFORMATION				
		ADA ADJ	AMERICANS WITH DISABILITIES ACT ADJUST, ADJUSTABLE	INT	INTERIOR	<u>}20x12</u> ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	DUCTWORK, WITH SOUNDLINING		PIPING TURNING DOWN
		AF AFF	ANTI-FREEZE ABOVE FINISHED FLOOR	INV EL ISOL	INVERT ELEVATION ISOLATION		VANED ELBOW		TEE DOWN
Α		ALUM AP	ALUMINUM ACCESS PANEL	IW	INDUSTRIAL WASTE, INDIRECT WASTE		UN-VANED ELBOW		PIPE BRANCH BOTTOM TAKEOFF
		APPROX	APPROXIMATELY ARCHITECTURAL	KW	KILOWATTS		RADIUS ELBOW		PIPE BRANCH TOP TAKEOFF
		AS AST ATV	ABOVEGROUND STORAGE TANK ATMOSPHERIC VENT	L LAV	LENGTH, LONG LAVATORY POLINDS		VANED TEE		VALVE IN VERTICAL PIPE
		AVG	AVERAGE	LDR LP	LEADER LIQUID PROPANE		UN-VANED TEE	l1	CAP
		BA BAS	BREATHABLE AIR BUILDING AUTOMATION SYSTEM	LPCR LPS	LOW PRESSURE CONDENSATE RETURN LOW PRESSURE STEAM				
		BFF BFP	BELOW FINISHED FLOOR BACKFLOW PREVENTER	LRA LWT	LOAD RATED AMPS LEAVING WATER TEMPERATURE			R/D	FLOW DIRECTION
		BLDG BLW	BUILDING BELOW	М	METER		RETURN DUCT TURNING UP AND DOWN		PIPE SLOPE RISE/DROP
		BOD	BUILDING MANAGEMENT SYSTEM BASIS OF DESIGN	MA MAV	MEDICAL AIR MANUAL AIR VENT		EXHAUST/RELIEF DUCT TURNING UP AND DOWN		PIPE RISER UP/DOWN
		BTU BTUH	BRITISH THERMAL UNIT BRITISH THERMAL UNITS PER HOUR	MAX	THOUSAND BRITISH THERMAL UNITS PER HOUR	R/D	DUCT RISE/DROP IN AIRFLOW DIRECTION	-⊳,-⊳	CONCENTRIC REDUCER/INCREASER
		С	COMMON	MCA MECH	MINIMUM CIRCUIT AMPACITY MECHANICAL		DUCT TRANSITION, SQUARE TO SQUARE	<u> </u>	ECCENTRIC REDUCER/INCREASER (FOB)
		CA CD	COMPRESSED AIR CONDENSATE DRAIN	MFR MIN	MANUFACTURER MINIMUM		DUCT TRANSITION, SQUARE TO ROUND		UNION
		CFH CHWR	CUBIC FEET PER HOUR CHILLED WATER RETURN	MO MPS	MOTOR OIL MEDIUM PRESSURE STEAM		DUCT CAPPED		
		CHWS		MTG	MOUNTED MOUNTING MAKE LID WATER	」 」 」 二 二 二 二			
			CEMPER LINE CEMENT-LINED DUCTILE IRON S PIPE CEILING	MV	MARE OF WATER MEDICAL VACUUM				EXPANSION LOOP (WXH)
		CNG CO	COMPRESSED NATURAL GAS CLEANOUT, CARBON MONOXIDE	N N/A	NITROGEN NOT APPLICABLE		CONICAL TAP		PIPE ANCHOR
В		CO2 COL	CARBON DIOXIDE COLUMN	NC NFPA	NORMALLY CLOSED, NOISE CRITERIA NATIONAL FIRE PROTECTION AGENCY		SPUN-IN RUNOUT FITTING W/ FLEX. & VD		FLEXIBLE PIPE CONNECTOR
		CONC CONN	CONCRETE CONNECTION	NFWH NG	NON-FREEZE WALL HYDRANT NATURAL GAS		FLEXIBLE DUCT	–== ^{EJ}	EXPANSION JOINT
		CONT CONT'D		NIC NO	NOT IN CONTRACT NORMALLY OPENED		FLEXIBLE CONNECTION		PIPE GUIDE
		CPVC CV	CHLORINATED POLYVINYL CHLORIDE CLEANING VACUUM, CHECK VALVE				MANUAL VOLUME DAMPER		STEAM TRAP
		CWR CWS	CONDENSER WATER RETURN CONDENSER WATER SUPPLY	NTS	NOT TO SCALE		FIRE DAMPER		
		Cx CxA	COMMISSIONING AUTHORITY	O/2, O2 OC	OXYGEN ON CENTER				
		(D)	DEMOLISH, REMOVE	OFD OI	OVERFLOW DRAIN OIL INTERCEPTOR		SWURE DAWPER		TEMPERATURE SENSOR
		D DB	DRAIN, DEPTH DECIBELS	OS&Y OSD	OUTSIDE STEM AND YOKE VALVE OPEN SITE DRAIN		COMBINATION FIRE/SMOKE DAMPER		PRESSURE SENSOR
			DOMESTIC COLD WATER DIRECT DIGITAL CONTROL	OVH OWS	OVERHEAD OIL WATER SEPARATOR		BACKDRAFT DAMPER		DIFFERENTIAL PRESSURE TRANSDUCER
		DEG, ° DEH DFPT	DEGREES DEHUMIDIFIER DEPARTMENT	% P	PERCENT UNDER CENT		MOTORIZED DAMPER	FS	FLOW SWITCH
		DESG	DESIGNATION DRAINAGE FIXTURE UNITS	PC PD	PUMPED CONDENSATE PRESSURE DROP	BD	BAROMETRIC DAMPER	FM	FLOW METER
		DHW DHWR	DOMESTIC HOT WATER DOMESTIC HOT WATER RETURN	PH PIW	PHASE PUMPED INDUSTRIAL WASTE		DUCT CONTINUATION		
		DI DIA, ø	DEIONIZED WATER DIAMETER	PLBG PNEU	PLUMBING PNEUMATIC				
		DIFF DISC	DIFFERENTIAL, DIFFERENCE DISCONNECT	POS PRESS	POSITION PRESSURE				PUMP
		DN DSB	DOWN DOWNSPOUT BOOT	PROP PRV	PROPELLER PRESSURE REDUCING VALVE PRESSURE REDUCING VALVE	OA	OUTSIDE AIR FLOW DIRECTION		
С		DTWR	HOT/CHILLED WATER RETURN (DUAL TEMP.)	PS PSC PSI	PRESSURE SWITCH PUMPED STEAM CONDENSATE RETURN POUNDS PER SQUARE INCH	-\>	RETURN/EXHAUST AIR FLOW DIRECTION	LINES 8	REFERENCE SYMBOLS
		DTWS	HOT/CHILLED WATER SUPPLY (DUAL TEMP.)	PSIG PVC	POUNDS PER SQUARE INCH GAUGE POLYVINYL CHLORIDE	, M	RETURN, EXHAUST GRILLE OR REGISTER		
		DWG		(RL)	RELOCATED POSITION		SUPPLY AIR DIFFUSER, 4-WAY BLOW		
		(ER) (EX)	EXISTING RELOCATED EXISTING TO REMAIN	R RD	RISE ROOF DRAIN, REFRIGERANT		SUPPLY AIR DIFFUSER, 3-WAY BLOW		
		EFF	EACH EFFICIENCY EXPANSION JOINT				SUPPLY AIR DIFFUSER. 2-WAY BLOW		
		EL ELEC	ELEVATION ELECTRIC, ELECTRICAL	RL RL	REFRIGERANT LIQUID RATED LOAD AMPS				
		ELEV EQ	ELEVATOR EQUAL	RM RPM	ROOM REVOLUTIONS PER MINUTE		SUFFLY AIR DIFFUSER, I-WAT BLOW		
		ET EWC	EXPANSION TANK ELECTRIC WATER COOLER	RPZ RS	REDUCED PRESSURE BFP REFRIGERANT SUCTION	<u> </u>	LINEAR SLOT DIFFUSER		POINT OF CONNECTION
			EXTERIOR	RWC			UNDERCUT DOOR		TERMINATION POINT OF DEMOLITION
		(F) FCO FD	FUTURE FLOOR CLEANOUT FLOOR DRAIN FIRE DAMPER	S S/S	SWITCH START/STOP SANITARY	DL 12x12	DOOR LOUVER		POINT OF FUTURE CONNECTION
		FDC FDR	FIRE DEPARTMENT CONNECTION	SC	STEAM CONDENSATE RETURN SUPPLY FAN, SQUARE FEET		DUCT ACCESS DOOR	#	SHEET KEYED NOTE
		FF FG	FINISHED FLOOR FUEL GAS	SK SP	SINK STATIC PRESSURE	AD T , T	THERMOSTAT, MASTER THERMOSTAT	/#	DRAWING REVISION NUMBER
		FLA FLEX	FULL LOAD AMPS FLEXIBLE	SPEC SPR	SPECIFICATION SPRINKLER	Т	TEMPERATURE SENSOR	 	
		FLR FM	FLOOR FLOW METER	SQ SQ FT	SQUARE SQUARE FOOT, SQUARE FEET	(H)	HUMIDISTAT		
•		FOF	FUEL OIL FUEL OIL FILL FUEL OIL RETURN	SS ST	STAINLESS STEEL STORM WATER PIPING	(FZ)	FREEZESTAT		NORTH ARROW
ט		FOS	FUEL OIL SUPPLY FUEL OIL VENT	STD STL STM	STEEL STEAM	HS	HUMIDITY SENSOR		
		FPM FPS	FEET PER MINUTE FEET PER SECOND	TEMP	TEMPERATURE, TEMPORARY	(H)	DUCT SMOKE DETECTOR		
		FRP FS	FIBERGLASS REINFORCED PLASTIC FLOW SWITCH	TP TW	TRAP PRIMER TEPID WATER	CO2	CARBON DIOXIDE SENSOR		JECK _ TYPE
		FT HD FT, '	FEET OF HEAD FOOT, FEET FREEZE FREEZE TOTAT	TYP	TYPICAL	CO	CARBON MONOXIDE SENSOR	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	L CD-1-150 DIFFUSER, REGISTER, OR GRILLE DESIGNATION AND AIRFLOW TAG(S)
		°F	DEGREES FAHRENHEIT	UL UON	UNDERWKITERS LABORATORIES UNLESS OTHERWISE NOTED	NOx	NITROGEN OXIDES SENSOR		└─ CFM
		G GA	GAS GAUGE	V VCO	VOLTS, VENT VERTICAL CLEAN OUT	SOx	SULFUR OXIDES SENSOR	VAV-1 8"	-DESIGNATION -DUCT INLET/PIPE SIZE VAV/AIR VAI VE TAG
		GAL GALV	GALLON, GALLONS GALVANIZED	VEL VERT	VELOCITY VERTICAL	00	GAS CONCENTRATION MONITOR	150	-CFM/GPM
		GCO GEN	GRADE CLEANOUT GENERATOR	VFD VIB	VARIABLE FREQUENCY DRIVE VIBRATION	SP	STATIC PRESSURE SENSOR		INDICATES PLAN/DETAIL NUMBER
		GPH GPM	GALAGE INTERCEPTOR GALLONS PER HOUR GALLONS PER MINITE	VSD VTR	VARIABLE SPEED DRIVE VENT THROUGH ROOF	AFMS	AIR FLOW MEASURING STATION		PLAN/DETAIL TITLE
		GW	GREASE WASTE GLYCOL WATER SUPPLY	W W/	WIDTH, WIDE	s	SWITCH OR TOGGLE SWITCH		V TITLE
		GWS	GLYCOL WATER RETURN	W/O WAGD	WITHOUT WASTE ANESTHETIC GAS DISPOSAL	ТМ	MANUAL TIMER SWITCH		E:SCALE (AS REQUIRED)
		H H2O	HEIGHT WATER	WC WCO	WATER CLOSET WALL CLEANOUT	HOA	HAND/OFF/AUTO SWITCH		
		HB HHWR	HOSE BIB HEATING HOT WATER RETURN	WFU WG	WATER SUPPLY FIXTURE UNITS WATER GAUGE		STATIC PRESSURE		INDICATES PLAN/DETAIL NUMBER
		HORIZ HP	HORIZONTAL HORSEPOWER	WHA	WATER HEATER, WALL HYDRANT WATER HAMMER ARRESTOR		CLASSIFICATION DESIGNATION (IN. W.G.)	1 (M301)	
Е		HPS HTG	HIGH PRESSURE STEAM HEATING	WPD WSHP	WATER PRESSURE DROP WATER SOURCE HEAT PUMP				INDICATES DRAWING ON WHICH DRAWING SECTION APPEARS
		HUM HWR	HUMIDIFIER HOT WATER RETURN	WT	WEIGHT				
		HWS HX	HOT WATER SUPPLY HEAT EXCHANGER	ZN	ZONE				
	l		TILITIZ (UTULES PER SECUND)						
2021									
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GANN									
0									

		MECH	VALVES
SYMBOL	THREE LINE PLAN	THREE LINE FLEVATION	DESCRIPTION
			GEN. SHUTOFF VALVE (BALL, GATE, BUTTERFLY)
			GATE VALVE
-54-			GLOBE VALVE
			OUTSIDE STEM & YOKE VALVE
⊣б⊢			BALL VALVE
⊣Г⊢			BUTTERFLY VALVE
			CHECK VALVE
$\neg \Delta \vdash$			GAS COCK
			PRESSURE REDUCING VALVE
$\neg \nabla \vdash$			CALIBRATED BALANCING VALVE
			CONTROL VALVE, TWO-WAY (ELECTRIC)
			CONTROL VALVE, THREE-WAY (ELECTRIC)
			THREE-WAY MANUAL VALVE
-X-			CONTROL VALVE, TWO-WAY (PNEUMATIC)
	2017		SOLENOID VALVE
<u>Þ</u>	2 1_© _?		RELIEF/SAFETY VALVE
- \ _ -			STRAINER
			STRAINER WITH DRAIN VALVE AND CAP
©∓_	2		PRESSURE GAUGE WITH COCK
_μ	2 6 2		THERMOMETER
			CONTROL VALVE, THREE-WAY (PNEUMATIC)
			FUSOMATIC GATE VALVE
			AUTOMATIC AIR VENT (EXTEND TO DRAIN)
<u> </u>			MANUAL AIR VENT
—⊔— ◇			PRESSURE/TEMPERATURE TEST PORT
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			NONWALLI OLOGLU FORT (NO)

PROVIDE ALL NEW AND REUSED WALL PENETRATIONS WITH A SLEEVE/CONDUIT FOR SERVICES PENETRATING IT. THIS INCLUDES, BUT IS NOT LIMITED TO: DUCTWORK, PIPING, POWER, AND CONTROL WIRING. THE CONTRACTOR SHALL SECURE AND PAY FOR ALL PERMITS AND INSPECTIONS REQUIRED BY ANY OF THE FOREGOING AUTHORITIES, AND PAY FOR ALL OTHER COSTS IN CONNECTION WITH THE WORK. CERTIFICATES SHALL BE IN DUPLICATE AND SHALL BE DELIVERED TO THE OWNER. THE SITE, LOCATION, AND ROUTING OF SYSTEMS INDICATED TO HAVE NEW CONNECTIONS MADE TO THEM ARE SHOWN AS ACCURATELY AS FIELD CONDITIONS PERMIT. CONTRACTOR SHALL VISIT THE SITE AND THOROUGHLY EXAMINE THE CONTRACT DRAWINGS. ALL EXISTING CONDITIONS SHALL BE EXAMINED AND THEIR EXACT LOCATIONS VERIFIED. THE CONTRACTOR SHALL REPORT TO THE ENGINEER ANY CONDITIONS WHICH MIGHT MAKE INSTALLATION OF REQUIRED EQUIPMENT A PROBLEM. NO CONSIDERATION OR ALLOWANCE WILL BE GRANTED FOR FAILURE TO INVESTIGATE CONDITIONS OR MISUNDERSTANDINGS OF THE CONTRACTUAL REQUIREMENTS. THE CONTRACTOR SHALL INSTALL AND CONNECT EQUIPMENT AND MATERIALS IN ACCORDANCE WITH THE BEST ENGINEERING PRACTICE AND, UNLESS OTHERWISE SHOWN OR SPECIFIED, FOLLOW THE MANUFACTURER'S PRINTED INSTALLATION REQUIREMENTS AND RECOMMENDATIONS, AND FURNISH AND INSTALL REQUIRED AUXILIARY ITEMS TO PROVIDE A COMPLETE INSTALLATION. THE CONTRACTOR SHALL REPAIR WALLS, CEILING, FLOORS, ETC., THAT ARE REQUIRED TO BE PENETRATED, OR OTHERWISE DISTURBED. THE REPAIRS SHALL BE WITH MATERIALS AND FINISHES TO MATCH EXISTING. FIRE WALL PENETRATIONS SHALL BE SEALED WITH SUITABLE MATERIALS TO PRESERVE FIRE WALL INTEGRITY. 0. THE CONTRACTOR SHALL REMOVE EQUIPMENT NOT INDICATED TO BE REUSED TO A DESIGNATED LOCATION AT THE PROJECT SITE. AFTER THE EQUIPMENT HAS BEEN ASSEMBLED FOR THE OWNER'S INSPECTION AND POSSIBLE RETENTION, ALL EQUIPMENT NOT TO BE RETAINED BY THE OWNER SHALL BE REMOVED FROM THE SITE BY THE CONTRACTOR. . COORDINATE WITH OTHER TRADES TO AVOID INTERFERENCE AMONG MECHANICAL, ELECTRICAL, ARCHITECTURAL AND STRUCTURAL, PLUMBING, ETC. PROVIDE NECESSARY OFFSETS IN PIPING, DUCTWORK AND FITTINGS ETC., REQUIRED TO PROPERLY INSTALL WORK WITHOUT INTERFERENCES. 12. BUILDING SYSTEMS SHALL REMAIN IN SERVICE UNLESS INDICATED OTHERWISE. OUTAGES OR INTERRUPTIONS SHALL BE KEPT TO A MINIMUM DURATION. NOTIFY THE OWNER 48 HOURS IN ADVANCE OF ANY OUTAGE OR INTERRUPTION. IF TEMPORARY CONNECTIONS ARE NECESSARY TO ASSURE THIS CONTINUITY OF SERVICES, THEY SHALL BE FURNISHED BY THE CONTRACTOR WITHOUT ADDITIONAL CHARGE TO THE OWNER AND SHALL BE REMOVED WHEN NO LONGER NEEDED. 3. THE CONTRACTOR SHALL ARRANGE AND EXECUTE HIS WORK SUCH THAT ANY CONNECTIONS, BOTH TEMPORARY OR PERMANENT, TO, OR REARRANGEMENT OF, PRESENT EQUIPMENT, PIPING, ETC., SHALL BE MADE IN SUCH A MANNER AS TO ASSURE FULL RESUMPTION OF SERVICE AT THE TIME DESIGNATED BY THE OWNER. 14. THE CONTRACTOR SHALL LOCATE EQUIPMENT WHICH MUST BE SERVICED, OPERATED OR MAINTAINED IN FULLY ACCESSIBLE POSITIONS, FURNISH ACCESS DOORS AS REQUIRED FOR BETTER ACCESSIBILITY. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR ACCESSIBILITY, BUT CHANGES OF MAGNITUDE WHICH INVOLVE EXTRA COSTS SHALL NOT BE MADE WITHOUT WRITTEN APPROVAL. 15. ALL DIMENSIONS FOR EXISTING PIPING AND DUCTWORK SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION, WHERE NEW WORK CONNECTIONS ARE INDICATED. NEW DUCT DIMENSIONS SHOWN ARE INSIDE CLEAR DIMENSIONS. 16. OPENINGS REMAINING IN EXISTING PIPING/DUCTWORK AS A RESULT OF DEMOLITION SHALL BE SEALED WITH AN AIRTIGHT/WATERTIGHT SHEET METAL CAP. WHERE EXISTING SYSTEMS ARE INSULATED, WORK SHALL INCLUDE REPAIR AND

A RESULT OF DEMOLITION.

2-1/2 OR LESS 1/4

8 OR LARGER 1/16

ABOVE CEILING WORK.

3 TO 6

SHALL BE IN ACCORDANCE WITH THE FOLLOWING:

1/8

SIZE (INCHES) MINIMUM SLOPE (INCHES PER FOOT)

ENTIRETY AS REQUIRED TO FACILITATE NEW WORK.

8

GENERAL NOTES

PERMIT, DIMENSIONS SHALL BE CONFIRMED IN THE FIELD.

WITH ANY OF THE SYSTEMS HEREIN SPECIFIED.

DISRUPTION TO ADJACENT SERVICES OR DAMAGING INSULATION. THIS INCLUDES, BUT IS NOT LIMITED TO:

FOR ISOLATION.

ON THESE CONTRACT DOCUMENTS.









mber 1:05:



- ON THE SAME SIDE AS RECEPTACLE. MODIFY EXISTING WINDOW SPANDREL TO ACCEPT NEW UNIT WITH WEATHERTIGHT SEAL. PROVIDE BRACING AND SUPPORT OF AIR CONDIITONING UNIT



THE SCHOOL DISTRICT OF PHILADELPHIA

OFFICE OF CAPITAL PROGRAMS









GENERAL NOTES:

1. LABEL ALL NEW EQUIPMENT, PIPING, AND CONTROLS.

2. INSULATE ALL NEW REFRGERANT SUCTION, REFRIGERANT LIQUID, AND CONDENSATE PIPING. PROVIDE UV-RESISTANT PVC JACKET ON ALL NEW INSULATED PIPING. PAINT PVC JACKET OF EXTERIOR PIPING ROUTED ALONG BRICKWORK TO MATCH COLOR OF BRICKS. 3. COORDINATE EFFORTS WITH SDP-PROCURED COMMISSIONING AGENT. 4. ALL EXISTING WINDOW AIR CONDITIONER UNITS TO BE REMOVED AND FURNISHED TO SDP OR DISCARDED OFFSITE AS DIRECTED BY SDP. INSTALL NEW AIR CONDITIONING UNITS IN PLACE AS INDICATED ON PLANS. 5. SUPPORT ALL INTERIOR AND VERTICAL EXTERIOR REFRIGERANT PIPING AND CONDUIT WITH UNISTRUT. SUPPORT ALL ROOFTOP HORIZONTAL EXTERIOR REFRIGERANT PIPING AND CONDUIT WITH MANUFACTURER ROOF PIPE BRIDGES. 6. PROCURE A ROOFING SUBCONTRACTOR CERTIFIED TO WORK ON ROOFING ASSEMBLY AND MAINTAIN ROOFING WARRANTY FOR ALL ROOFING WORK. 1/M105 **GYMNASIUM 1** 154A MECHANICAL GYMNASIUM 2

 $\langle \# \rangle$ <u>Sheet Keynotes:</u>

- 1. PROVIDE WINDOW AIR CONDITIONING UNIT WITH CORDED PLUG ON THE SAME SIDE AS RECEPTACLE. MODIFY EXISTING WINDOW SPANDREL TO ACCEPT NEW UNIT WITH WEATHERTIGHT SEAL. PROVIDE BRACING AND SUPPORT OF AIR CONDIITONING UNIT INDEPENDENT OF WINDOW FRAMING ASSEMBLY.
- 2. REMOVE EXISTING WINDOW AIR CONDITIONER AND FURNISH TO SDP. PROVIDE NEW WINDOW AIR CONDITIONING UNIT WITH CORDED PLUG ON THE SAME SIDE AS RECEPTACLE. MODIFY EXISTING WINDOW SPANDREL TO ACCEPT NEW UNIT WITH WEATHERTIGHT SEAL. PROVIDE BRACING AND SUPPORT OF AIR CONDIITONING UNIT INDEPENDENT OF WINDOW FRAMING ASSEMBLY.
- 3. PROVIDE SPLIT SYSTEM HEAT PUMP INDOOR UNIT AND OUTDOOR UNIT. FURNISH NEMA 12 AND NEMA 3R DISCONNECT SWITCHES TO THE ELECRICAL CONTRACTOR. PROVIDE MANUFACTURER'S WALL MOUNTING ASSEMBLY FOR INDOOR UNIT AND OUTDOOR UNIT. PROVIDE INSULATED REFRIGERANT SUCTION, REFRIGERANT LIQUID, AND CONDENSATE PIPING. TERMINATE CONDENSATE PIPING WITH ELBOW 8" ABOVE GRADE.
- 4. REMOVE EXISTING INDOOR AND OUTDOOR UNITS. PROVIDE NEW SPLIT SYSTEM HEAT PUMP INDOOR UNIT IN PLACE WITH MANUFACTURER MOUNTING ASSEMBLY. PROVIDE NEW OUTDOOR UNIT AND REUSE EXISTING MOUNTS AS AVAILABLE. FURNISH NEMA 12 AND NEMA 3R DISCONNECT SWITCHES TO THE ELECRICAL CONTRACTOR. PROVIDE INSULATED REFRIGERANT SUCTION, REFRIGERANT LIQUID, AND CONDENSATE PIPING. TERMINATE CONDENSATE PIPING WITH ELBOW 8" ABOVE GRADE. PROVIDE CONDENSATE PUMP AND INSULATED CONDENSATE PIPING. MODIFY ROOF PENETRATION AS NEEDED FOR DEMOLITION AND NEW WORK. SEAL PENETRATION WEATHERTIGHT.
- REMOVE EXISTING BAND ROOM HEATING & VENTILATION UNIT, COOLING COIL, AND AIR COOLED CONDENSER. REMOVE STEAM AND STEAM CONDENSATE PIPING AT UNIT AND CAP PIPING AT NEAREST BRANCH OR PENETRATION INTO SPACE. PROVIDE NEW PACKAGED HEAT PUMP ROOFTOP UNIT ON EXISTING DUNNAGE. FURNISH DISCONNECT SWITCH TO ELECTRICAL CONTRACTOR. CONNECT EXISTING SUPPLY AIR AND RETURN AIR SMOKE DETECTORS TO UNIT. REMOVE AND REINSTALL SMOKE DETECTORS AS NEEDED.



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BRIAN M. WEISSER PA PE083639	
MECHANICAL / PLU	JMBING ENGINEER:
GANNETT FLEMING 1010 ADAMS AVEN VALLEY FORGE PA	, INC. UE 19403
Phone: 610.783.386 Email: BWEISSER@G	52 GFNET.COM
Attn: BRIAN WEISSE	R
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THE SCHOOL DISTRICT OF

OFFICE OF CAPITAL PROGRAMS

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sct Number: 068625.001	

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1) MECHANICAL HVAC SECOND FLOOR PLAN - NORTH SCALE: 1/16" = 1'-0"



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- 6. PROCURE A ROOFING SUBCONTRACTOR CERTIFIED TO WARRANTY FOR ALL ROOFING WORK.
- ROOF PIPE BRIDGES. WORK ON ROOFING ASSEMBLY AND MAINTAIN ROOFING
- REFRIGERANT PIPING AND CONDUIT WITH MANUFACTURER
- 5. SUPPORT ALL INTERIOR AND VERTICAL EXTERIOR REFRIGERANT PIPING AND CONDUIT WITH UNISTRUT. SUPPORT ALL ROOFTOP HORIZONTAL EXTERIOR
- 4. ALL EXISTING WINDOW AIR CONDITIONER UNITS TO BE REMOVED AND FURNISHED TO SDP OR DISCARDED OFFSITE AS DIRECTED BY SDP. INSTALL NEW AIR CONDITIONING UNITS IN PLACE AS INDICATED ON PLANS.
- 3. COORDINATE EFFORTS WITH SDP-PROCURED COMMISSIONING AGENT.
- 1. LABEL ALL NEW EQUIPMENT, PIPING, AND CONTROLS. 2. INSULATE ALL NEW REFRGERANT SUCTION. REFRIGERANT LIQUID, AND CONDENSATE PIPING. PROVIDE UV-RESISTANT PVC JACKET ON ALL NEW INSULATED PIPING. PAINT PVC JACKET OF EXTERIOR PIPING ROUTED ALONG BRICKWORK TO MATCH COLOR OF BRICKS.
- GENERAL NOTES:

MANUFACTURER'S WALL MOUNTING ASSEMBLY FOR INDOOR UNIT AND OUTDOOR UNIT. PROVIDE INSULATED REFRIGERANT SUCTION, REFRIGERANT LIQUID, AND CONDENSATE PIPING. TERMINATE CONDENSATE PIPING WITH ELBOW 8" ABOVE GRADE. 4. REMOVE EXISTING INDOOR AND OUTDOOR UNITS. PROVIDE NEW SPLIT SYSTEM HEAT PUMP INDOOR UNIT IN PLACE WITH MANUFACTURER MOUNTING ASSEMBLY. PROVIDE NEW OUTDOOR UNIT AND REUSE EXISTING MOUNTS AS AVAILABLE. FURNISH NEMA 12 AND NEMA 3R DISCONNECT SWITCHES TO THE ELECRICAL CONTRACTOR. PROVIDE INSULATED REFRIGERANT SUCTION, REFRIGERANT LIQUID, AND CONDENSATE PIPING.

TERMINATE CONDENSATE PIPING WITH ELBOW 8" ABOVE GRADE.

<u>KEY PLAN</u>

OUTDOOR UNIT. FURNISH NEMA 12 AND NEMA 3R DISCONNECT

SWITCHES TO THE ELECRICAL CONTRACTOR. PROVIDE

- 2. REMOVE EXISTING WINDOW AIR CONDITIONER AND FURNISH TO SDP. PROVIDE NEW WINDOW AIR CONDITIONING UNIT WITH CORDED PLUG ON THE SAME SIDE AS RECEPTACLE. MODIFY EXISTING WINDOW SPANDREL TO ACCEPT NEW UNIT WITH WEATHERTIGHT SEAL. PROVIDE BRACING AND SUPPORT OF AIR CONDIITONING UNIT INDEPENDENT OF WINDOW FRAMING ASSEMBLY. 3. PROVIDE SPLIT SYSTEM HEAT PUMP INDOOR UNIT AND
- 1. PROVIDE WINDOW AIR CONDITIONING UNIT WITH CORDED PLUG ON THE SAME SIDE AS RECEPTACLE. MODIFY EXISTING WINDOW SPANDREL TO ACCEPT NEW UNIT WITH WEATHERTIGHT SEAL. PROVIDE BRACING AND SUPPORT OF AIR CONDIITONING UNIT INDEPENDENT OF WINDOW FRAMING ASSEMBLY.
- $\langle \# \rangle$ <u>Sheet Keynotes:</u>

	COFFICE OF CAPITAL 440 NORTH BRC PHILADELPHIA, PA (215) 400 - 4730 (21 www.philo SEAL:	L DISTRICT OF DELPHIA L PROGRAMS DAD STREET A 19130 - 4015 5) 400 - 4731 (fax) asd.org			
D PLUG VINDOW SEAL. UNIT AISH TO TH DIFY H OF AIR GF AIR MINECT DOOR RANT IG. GRADE. DE NEW ABLE. S TO THE ERANT IG. GRADE. GRADE.	BRIAN M. WEISSER PA PEOB36339 ENGINEER OF RECORD: MECHANICAL / PLUMBING ENGINEER: GANNETT FLEMING, INC. 1010 ADAMS AVENUE VALLEY FORGE, PA 19403 Phone: 610.783.3862 Email: BWEISSER@GFNET.COM Attn: BRIAN WEISSER				
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GENERAL NOTES:

- 1. LABEL ALL NEW EQUIPMENT, PIPING, AND CONTROLS.
- 2. INSULATE ALL NEW REFRGERANT SUCTION, REFRIGERANT LIQUID, AND CONDENSATE PIPING. PROVIDE UV-RESISTANT PVC JACKET ON ALL NEW INSULATED PIPING. PAINT PVC JACKET OF EXTERIOR PIPING ROUTED ALONG BRICKWORK TO MATCH COLOR OF BRICKS.
- 3. COORDINATE EFFORTS WITH SDP-PROCURED
- COMMISSIONING AGENT.4. ALL EXISTING WINDOW AIR CONDITIONER UNITS TO BE REMOVED AND FURNISHED TO SDP OR DISCARDED
- OFFSITE AS DIRECTED BY SDP. INSTALL NEW AIR CONDITIONING UNITS IN PLACE AS INDICATED ON PLANS.
 5. SUPPORT ALL INTERIOR AND VERTICAL EXTERIOR DEEDICEBANT DIDING AND CONDULT WITH UNISTRUCT.
- REFRIGERANT PIPING AND CONDUIT WITH UNISTRUT. SUPPORT ALL ROOFTOP HORIZONTAL EXTERIOR REFRIGERANT PIPING AND CONDUIT WITH MANUFACTURER ROOF PIPE BRIDGES.
- 6. PROCURE A ROOFING SUBCONTRACTOR CERTIFIED TO WORK ON ROOFING ASSEMBLY AND MAINTAIN ROOFING WARRANTY FOR ALL ROOFING WORK.

<u>SHEET KEYNOTES:</u>

- 1. REMOVE EXISTING HEATING & VENTILATION UNIT. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS, AND APPURTENANCES. REMOVE PIPING AND DUCTWORK AS INDICATED.
- 2. REMOVE STEAM AND STEAM CONDENSATE PIPING. CAP PIPING AT NEAREST BRANCH OR PENETRATION INTO SPACE.
- 3. REMOVE ALL REFRIGERANT PIPING FROM COOLING COIL TO AIR COOLED CONDENSER. PATCH AND SEAL OPENINGS LEFT IN THE WALL TO MATCH EXISTING.
- REMOVE EXISTING AIR COOLED CONDENSER. EXISTING DUNNAGE TO REMAIN.
- 5. CONNECT EXISTING SUPPLY AND RETURN AIR SMOKE DETECTORS TO NEW ROOFTOP UNIT. REMOVE AND REINSTALL SMOKE DETECTORS AS NEEDED.
- 6. PROVIDE NEW PACKAGED HEAT PUMP ROOFTOP UNIT ON EXISTING DUNNAGE. PROVIDE WITH INTEGRAL DISCONNECT SWITCH AND CONVENIENCE OUTLET. PROVIDE NEW PENETRATION THROUGH EXTERIOR WALL FOR SUPPLY DUCTWORK. SLEEVE AND SEAL ANNULAR SPACE OF PENETRATION WEATHERTIGHT. PROVIDE TWO INCHES OF ELASTOMERIC FOAM INSULATION WITH UV-RESISTANT PVC JACKET ON ALL EXTERIOR DUCTWORK. PROVIDE ONE INCH OF FIBERGLASS INSULATION WITH KRAFT PAPER JACKET ON ALL INTERIOR DUCTWORK.
- PROVIDE RETURN AIR DUCTWORK THROUGH EXISTING 20"x50" OPENING. PROVIDE INSULATED PANEL TO BLOCK OFF REMAINING OPENING.

	ICE OF CAP	ITAL PROGRAMS
	440 NORTH	BROAD STREET
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TO WALL ACCORDING	3
URERS SPECIFICATION)N

INSULATION THICKNESS SCHEDULE							
	INSULATION CONDUCTIVITY			NOMINAL PIPE OR TUBE SIZE (INCHES)			
FLUID OPERATING EMPERATURE RANGE AND USAGE (F)	CONDUCTIVITY (BTU-IN/(H-FT^2-F))	MEAN RATING TEMP. (F)	< 1	1 TO < 1.5	1.5 TO < 4	4 TO < 8	≥8
ING SYSTEMS (CHILLED WATER, REFRIGERANT, AIR CONDITIONING CONDENSATE)							
40 - 60	0.21 - 0.27	75	0.5	0.5	1	1	1
< 40	0.20 - 0.26	50	0.5	1	1	1	1.5

ACU-244 <u>REMARKS</u>

MARK

ACU-002

ACU-003

ACU-004

ACU-005

ACU-006

ACU-007 ACU-008

ACU-009

ACU-010

ACU-011 ACU-012-1

ACU-012-2

ACU-013-1 ACU-013-2 ACU-014 ACU-015-1 ACU-015-2 ACU-016A ACU-016B

ACU-017A

ACU-017B ACU-017C

ACU-018D

ACU-019A

ACU-019B

ACU-023

ACU-024

ACU-025

ACU-033 ACU-034

ACU-056 ACU-057 ACU-100A

ACU-100B ACU-101-1 ACU-101-2 ACU-101A ACU-101J ACU-101K ACU-101L ACU-101M

ACU-102 ACU-104 ACU-105B ACU-106

ACU-108

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ACU-140-2

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		ELE		CAL	APPROX. OPERATING	BASIS OF DE	SIGN	
AIRFLOW (CFM)	CAPACITY (MBH)	v	ø	HZ	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
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300 300 300 300	12 12 12 12	230 230 230 230	1 1 1	60 60 60	116 116 116 116	FRIEDRICH FRIEDRICH FRIEDRICH FRIEDRICH	KCS12A30A KCS12A30A KCS12A30A KCS12A30A	1 1 1 1
330 300 300	15.7 12 12	230 230 230	1 1 1	60 60 60	141 116 116	FRIEDRICH FRIEDRICH FRIEDRICH	KCS16A30A KCS12A30A KCS12A30A	1 1 1 1
725 725 725	35 35 35	230 230 230	1 1 1	60 60 60	212 212 212	FRIEDRICH FRIEDRICH FRIEDRICH	KCL36A30A KCL36A30A KCL36A30A	1 1 1
725 725 725	35 35 35	230 230 230	1 1 1	60 60 60	212 212 212	FRIEDRICH FRIEDRICH FRIEDRICH	KCL36A30A KCL36A30A KCL36A30A	1 1 1
725 640 725	35 28 35	230 230 230	1 1 1	60 60 60	212 193 212	FRIEDRICH FRIEDRICH FRIEDRICH	KCL36A30A KCL28A30A KCL36A30A	1 1 1
640 640 640	28 28 28	230 230 230	1 1 1	60 60 60	193 193 193	FRIEDRICH FRIEDRICH FRIEDRICH	KCL28A30A KCL28A30A KCL28A30A	1 1 1
725 300 725	35 12 35	230 230 230	1 1 1	60 60 60	212 116 212	FRIEDRICH FRIEDRICH FRIEDRICH	KCL36A30A KCS12A30A KCL36A30A	1 1 1
725 640 725	35 28 35	230 230 230	1 1 1	60 60 60	212 193 212	FRIEDRICH FRIEDRICH FRIEDRICH	KCL36A30A KCL28A30A KCL36A30A	1 1 1
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300 640	12 28 28	230 230 230	1	60 60 60	116 193	FRIEDRICH FRIEDRICH	KCS12A30A KCL28A30A	1
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725 640 330	35 28 15.7	230 230 230	1 1 1	60 60 60	212 193	FRIEDRICH FRIEDRICH ERIEDRICH	KCL36A30A KCL28A30A KCS16A30A	1 1 1
725 640	35 28 28	230 230 230	1	60 60 60	212 193	FRIEDRICH FRIEDRICH	KCL36A30A KCL28A30A	1
640 640 640	28 28 28	230 230 230	1 1 1	60 60 60	193 193 193	FRIEDRICH FRIEDRICH FRIEDRICH	KCL28A30A KCL28A30A KCL28A30A	1 1 1
640 640 640	28 28 28	230 230 230	1 1 1	60 60 60	193 193 193	FRIEDRICH FRIEDRICH FRIEDRICH	KCL28A30A KCL28A30A KCL28A30A	1 1 1
725 725 725	35 35 35	230 230 230	1 1 1	60 60 60	212 212 212 212	FRIEDRICH FRIEDRICH FRIEDRICH	KCL36A30A KCL36A30A KCL36A30A	1 1 1
640 725 725	28 35 35	230 230 230	1 1 1	60 60 60	193 212 212	FRIEDRICH FRIEDRICH FRIEDRICH	KCL28A30A KCL36A30A KCL36A30A	1 1 1
640 640 640	28 28 28	230 230 230	1 1 1	60 60 60	193 193 193	FRIEDRICH FRIEDRICH FRIEDRICH	KCL28A30A KCL28A30A KCL28A30A	1 1 1
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040 725 640	28 35 28	230 230 230	1 1 1	60 60 60	193 212 193	FRIEDRICH FRIEDRICH FRIEDRICH	KCL36A30A KCL28A30A	1 1 1
640 640 725	28 28 35	230 230 230	1 1 1	60 60 60	193 193 212	FRIEDRICH FRIEDRICH FRIEDRICH	KCL28A30A KCL28A30A KCL36A30A	1 1 1
640 640 640 725	28 28 28 35	230 230 230 230	1 1 1 1	60 60 60 60	193 193 193 212	FRIEDRICH FRIEDRICH FRIEDRICH	KCL28A30A KCL28A30A KCL28A30A KCL36A30A	1 1 1 1 1
640 725 300	28 35 12	230 230 230	1 1 1	60 60 60	193 212 116	FRIEDRICH FRIEDRICH FRIEDRICH	KCL28A30A KCL36A30A KCS12A30A	1 1 1 1
640 725	28 35	230 230	1	60 60	193 212	FRIEDRICH	KCL28A30A KCL36A30A	1

1. PROVIDE WITH 3' CORDED PLUG AND INTEGRAL THERMOSTAT.

OFFICE OF CAP	
440 NORTH PHILADELPHIA (215) 400 - 4730 www.	BROAD STREET A, PA 19130 - 4015 (215) 400 - 4731 (fax) .philasd.org
SEAL:	
BRIAN M. WEISSER PA PE083639	
ENGINEER OF REC	ORD:
MECHANICAL / PLL GANNETT FLEMING	JMBING ENGINEER: , INC.
VALLEY FORGE, PA Phone: 610.783.386	0E 19403 52 SENET COM
Attn: BRIAN WEISSE	R
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			ELECT		DATA		APPROX.	BASIS OF DE	SIGN			-					DX	COOLING C	OIL DATA			STEAM I	HEATING	COIL D	ГА	ELE	CTRICA		A	BASIS OF D	SIGN	
MARK	COOLING CAPACITY (MBH)	v	Ø	HZ N	IC A MC	O DCP	DPERATING WEIGHT (LBS)	MANUFACTU	JRER	REMAR	KS			AIRFLOV		TOTA DE COOLIN W CAPAC	L NG SI ITY C	ENSIBLE OOLING			G H P CAF	EAT PACITY		ING L MP A	EAVING IR TEMP							
CU-133-1	30	208	1	60	19 2	26	155	CARRIER OR ACCE OTHER	EPTABLE	1, 2			MARK	(CFM)	(CFM)	(MBH	I) CAPA	CITY (MBH)	(F°)	(F°)	(N	IBH)	(F°		(F°)	V	Ø	HZ M		UFACTURER	MODEL	REMARKS
CU-133-2	30	208	1	60	19 2	26	155	CARRIER OR ACCE	EPTABLE	1, 2		-	UV-133-1	1260 1260	390	36		30	80	55		50	52		92	208 208	3	$\frac{60}{60}$ 20	<u>).0</u>	CARRIER	UV40	1, 2
INTEGR PROVIE	ATE WITH RES DE NEMA 3R DIS	PECTIVE	UNIT VE	NTILATOF	R CONTOI	OLS. ENT COO	DLING KIT.						 PROVIE OUTSIE COMPF INTEGF PROVIE PIPE CI PROFE 	DE THE FOLOV DE AIR DRY BL RESSOR; NON RATION INTO A DE AND/OR IN HASE ENCLOS SSIONAL FINIS	VING FACTOR ILB ECONOMI FUSED DISCO BAS. STALL THE FO SURE; SIDE EX	Y OPTIONS: ZER; SUPPLY, F DNNECT SWITC LLOWING IN FIL TENSIONS TO D		O OUTSIDE AIR 1 ED SWITCH; 1" F GS; CONDENSIN	TEMPERATUR TILTER; PSC M NG UNIT AS SC	E SENSORS; M DTORS; 14 GAU CHEDULED; SE		OUTSIDE A I; STANDAR		SPRING R /ITH SCREI BACK; PA	ETURN TYPE EN DX REFR TCH AND RE	E WITH A IGERAN PAIR SL	ACTUATOR T COIL AN	:; FAN RE D SS DR NG FLO(ELAY; CONTR AIN PAN; ANE DR/WALLS FC	OL TRANSFORMER; L D LOCAL CONTROLLE DR PROFFESIONAL FI	OW TEMPERATURE R WITH BACNET CA NISH; FIELD MODIFY	E LOCK OUT ON NRD FOR FUTURE Y ADJACENT BOOKCASE
								-	1	1		T				PAC	NAGEI			KUUFIC					I							
								AIRFLOW		SUPPLY	ESP	TOTAL	I SENSIBLE				DX TOTAL	HEATING EA DB LA D		RIC HEAT					RE				PPROX. ERATING	BASIS O		
							MARK					MRH	IVIDN	(г)	(г) (г) (()		(F) (F)	<i>)</i> N ¥¥	STAGES	vyv				ER TYF	'E	(LB2)	ANE!	GHI (LBS		R MODEL	REMARK

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						U	NIT VENTIL	ATOR SO	CHEDUL	E						
				DX COOLING C	OIL DATA		STEAM H	IEATING COIL	_ DTA	ELE	CTRI	CAL D	ATA	BASIS OF DE	ESIGN	
MARK	AIRFLOW (CFM)	OUTSIDE AIRFLOW (CFM)	TOTAL COOLING CAPACITY (MBH)	SENSIBLE COOLING CAPACITY (MBH)	ENTERING AIR TEMP (F°)	LEAVING AIR TEMP (F°)	HEAT CAPACITY (MBH)	ENTERING AIR TEMP (F°)	LEAVING AIR TEMP (F°)	v	Ø	HZ	MCA	MANUFACTURER	MODEL	REMARKS
UV-133-1	1260	390	36	30	80	55	50	52	92	208	3	60	20.0	CARRIER	UV40	1, 2
UV-133-2	1260	390	36	30	80	55	50	52	92	208	3	60	20.0	CARRIER	UV40	1, 2
1. PROVID																

PAC	KAGE	D HE	AT PL	JMP	ROOFT	OP l	JNIJ	r sc	HEDI	JLE							
	DX	HEATIN	G	ELECI	FRIC HEAT		ELE	CTRIC	AL DAT	Ά		REFRI	GERANT	APPROX.	BASIS OF D	ESIGN	
LA WB	TOTAL	EA DB	LA DB										CHARGE	OPERATING			
(F)	MBH	(F)	(F)	kW	STAGES	V	Ø	HZ	MCA	MOCP	EER	TYPE	(LBS)	WEIGHT (LBS)	MANUFACTUER	MODEL	REMARKS
59	42.9	70	86	12	2	208	3	60	63.0	70.0	13.0	R410	10.8	1067	TRANE	WHC060H3	

2. PROVIDE LOCAL, INDEPENDENT CONTROLLER WITH BACNET CARD FOR FUTURE INTEGRATION INTO A BUILDING AUTOMATION SYSTEM (BAS).

DUCTLESS SPLIT SYS	DOOR UNIT SCHEDULE	

			EL	ECTR		ТА	APPROX.	BASIS OF DE	SIGN			
MARK	SENSIBE COOLING (BTU/H)	HZ	FLA	MC A	МОСР	SCCR (kA)	OPERATING WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS		
ODU-001	18,000 - 12,200	60	0.5	11.0	28.0	5.0	99	MITSUBISHI	PUY-A18NKA7	1, 2, 3		
ODU-009A	18,000 - 12,200	60	0.5	11.0	28.0	5.0	99	MITSUBISHI	PUY-A18NKA7	1, 2, 3		
ODU-012D	18,000 - 12,200	60	0.5	11.0	28.0	5.0	99	MITSUBISHI	PUY-A18NKA7	1, 2, 4		
ODU-014A	18,000 - 12,200	60	0.5	11.0	28.0	5.0	99	MITSUBISHI	PUY-A18NKA7	1, 2, 4		
ODU-018B	24,000 - 18,500	60	0.4	19.0	26.0	5.0	151	MITSUBISHI	PKA-A24NHA7	1, 2, 3		
ODU-018C	24,000 - 18,500	60	0.4	19.0	26.0	5.0	151	MITSUBISHI	PKA-A24NHA7	1, 2, 3		
ODU-034A	18,000 - 12,200	60	0.5	11.0	28.0	5.0	99	MITSUBISHI	PUY-A18NKA7	1, 2, 3		
ODU-101	36,400 - 26,900	60	2.4	22.1	40.0	5.0	139	MITSUBISHI	MXZ-4C36NA2	1, 2, 3		
ODU-101D	36,400 - 26,900	60	2.4	22.1	40.0	5.0	139	MITSUBISHI	MXZ-4C36NA2	1, 2, 3		
ODU-120	18,000 - 12,200	60	0.5	11.0	28.0	5.0	99	MITSUBISHI	PUY-A18NKA7	1, 2, 3		
ODU-145	36,400 - 26,900	60	2.4	22.1	40.0	5.0	139	MITSUBISHI	MXZ-4C36NA2	1, 2, 3		
ODU-207A	18,000 - 12,200	60	0.5	11.0	26.0	5.0	151	MITSUBISHI	PKA-A24NHA7	1, 2, 4		
ODU-226	36,400 - 26,900	60	2.4	22.1	40.0	5.0	139	MITSUBISHI	MXZ-4C36NA2	1, 2, 3		
ODU-230	24,000 - 18,500	60	0.4	19.0	26.0	5.0	151	MITSUBISHI	PKA-A24NHA7	1, 2, 4		

FURNISH NEMA 3R DISCONNECT SWITCH TO ELECTRICAL CONTRACTOR.
 PROVIDE WITH LOW-AMBIENT COOLING KIT.
 PROVIDE MANUFACTURER'S WALL MOUNTING ASSEMBLY.
 REMOVE EXISTING UNIT AND REUSE MOUNTING ASSEMBLY WHERE APPLICABLE

	SUPPLY	OUTSIDE	PACKAC COOLING CAPACITY	GED TER	ELE			CONDITIO APPROX. OPERATING	NING UNIT SC BASIS OF DE		
MARK	AIRFLOW (CFM)	AIRFLOW (CFM)	(MBH) (BTU/H)	CAPACITY (MBH)	v	ø	HZ	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
PTAC-035	250-400	52	9600	8500	208	1	60	115	FRIEDRICH	PVH09K3FB	1,2,3
PTAC-035B	250-400	52	9600	8500	208	1	60	115	FRIEDRICH	PVH09K3FB	1,2,3

DUCTLESS SPLIT SYSTEM INDOOR UNIT SCHEDULE

				ELEC ⁻	TRICA	L DATA	APPROX.	BASIS OF DE	SIGN	
MARK	AIRFLOW (CFM)	SENSIBE COOLING (BTU/H)	HZ	FLA	МСА	SCCR (kA)	OPERATING WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
IDU-001	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-009A	635-705-775	24,000 - 18,500	60	0.4	1.0	5.0	46	MITSUBISHI	PKA-A24HA7	1, 2, 3
IDU-012D	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-014A	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-018B	635-705-775	24,000 - 18,500	60	0.4	1.0	5.0	46	MITSUBISHI	PKA-A24HA7	1, 2, 3
IDU-018C	635-705-775	24,000 - 18,500	60	0.4	1.0	5.0	46	MITSUBISHI	PKA-A24HA7	1, 2, 3
IDU-034A	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-101D	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-101E	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-101F	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-101H	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-120	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-145A	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-145C	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-207A	635-705-775	24,000 - 18,500	60	0.4	1.0	5.0	46	MITSUBISHI	PKA-A24HA7	1, 2, 3
IDU-226	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-226B	320-370-425	18,000 - 12,200	60	0.3	1.0	5.0	29	MITSUBISHI	PKA-A18HA7	1, 2, 3
IDU-230	635-705-775	24,000 - 18,500	60	0.4	1.0	5.0	46	MITSUBISHI	PKA-A24HA7	1, 2, 3

FURNISH DISCONNECT SWITCH TO ELECTRICAL CONTRACTOR.
 PROVIDE REMOTE-MOUNTED, PROGRAMMABLE THERMOSTAT, CONTROL WIRE, CONDUIT, AND LOCKABLE CLEAR LEXAN COVER.
 PROVIDE MANUFACTURER'S WALL MOUNTING ASSEMBLY.

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(OFF		F CAP	TAL	PROG	RAMS
		440 I PHILAD		BRO/	AD STRE	ET - 4015
		(215) 400) - 4730	(215)) 400 - 47	- 4015 /31 (fax)
-			www.	philas	d.org	
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	NO 5CH 601		ISSUEI 05/1	D FO 12/20	R BID D21	
	NO SCH 601		<u>ISSUEI</u> <u>05/</u> 	D FO 12/20	R BID D21	
	NO SCH 601		<u>ISSUEI</u> <u>05/</u> 	D FO 12/20	R BID D21	
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	NO SCH 601		ISSUEI 05/1	D FO 12/20	R BID D21	
	NO SCH 601 PRC AIR			D FO 12/20	REVIS PHILAD	
	NO SCH 601 PRC AIR			D FO 12/20	R BID 21 REVIS N PHILAD	
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ONE LINE DIAGRAM	ABBREVIATIONS		
	A or AMP AMPERE		
AF AMP FRAME	AC ALTERNATING CURRENT AFF ABOVE FINISH FLOOR		
	AFG ABOVE FINISH GRADE		
LISG ELECTRICALLY OPERATED	AS AMMETER SELECTOR SWITCH AMMETER SELECTOR SWITCH		
L- LONG TIME S- SHORT TIME	ATS AUTOMATIC TRANSFER SWITCH		
G GROUND FAULT	AUTO AUTOMATIC AWG AMERICAN WIRE GAUGE		
	BLDG BUILDING		
CIRCUIT BREAKER	C CONDUIT		
	CP CONTROL PANEL CPT CONTROL POWER TRANSFORMER		
ST - SHUNT TRIP	DISC DISCONNECT		
— ST GF - GROUND FAULT EO - ELECTRICALLY OPERATED	DIV DIVISION DS DISCONNECT SWITCH		
	EC ELECTRICAL CONTRACTOR		
MEDIUM VOLTAGE ISOLATION SWITCH	ECH ELECTRIC CABINET HEATER EF EXHAUST FAN		
	EMT ELECTRICAL METALLIC TUBING(CONDUIT) ELECTRICAL METALLIC TUBING(CONDUIT)		
FUSED CUTOUT	EP EXPLOSION PROOF		
	FAAP FIRE ALARM ANNUNCIATOR PANEL		
FUSED LOAD BREAK SWITCH	FRE FIBERGLASS REINFORCED EPOXY		
CONTACTOR	GRU GROUND FAULT IN TERRUPTER GRD GROUND		
	HID HIGH INTENSITY DISCHARGE		
1 NEMA SIZE (FVNR UNLESS OTHERWISE NOTED)	HP HORSEPOWER HPS HIGH PRESSURE SODIUM		
	HVAC HEATING - VENTILATION - AIR CONDITIONING		
	IG ISOLATED GROUND IND INDUSTRIAL		
VFD VARIABLE FREQUENCY DRIVE	JIC JOINT INDUSTRIAL COUNCIL		
	KV KILOVOLT		
	KVA KILOVOLT AMPERE KW KILOWATT		
	LA LIGHTNING ARRESTOR		
VOLTAGE TRANSFORMER	LC LIGHTING CONTACTOR LTG LIGHTING		
2 NUMBER REQUIRED			
	MLO MAIN LUG ONLY MOA MULTIOUTIET ASSEMBLY		
	MOD MOTOR OPERATED DAMPER		
	MTD MOUNTED MV MEDIUM VOLTAGE		
ACCURACY CLASS			
GROUND FAULT CURRENT TRANSFORMER	NC NORMALLY CLOSED		
	No NUMBER		
5 MOTOR, NUMBER INDICATES HORSE POWER	PMT PAD MOUNTED TRANSFORMER		
GENERATOR	PNL PANEL PT POTENTIAL TRANSFORMER		
ATS - AUTOMATIC TRANSFER SWITCH ATS MANUAL TRANSFER SWITCH	RECP RECEPTACLE RGS RIGID GALVANIZED STEEL(CONDUIT)		
	RVA1 REDUCED VOLTAGE AUTOTRANSFORMER RVSS REDUCED VOLTAGE SOLID STATE		
	SC SURGE CAPACITOR		
	SPD SURGE PROTECTION DEVICE SW SWITCH		
A METER	SWBD SWITCHBOARD		
	TC CABLE TRAY - CABLE TTB TELEPHONE TERMINAL BOARD		
	TTC TELEPHONE TERMINAL CABINET TYP TYPICAL		
KVAR - KILOVAT HOUK KVAR - KILOVAR METER	UH UNIT HEATER		
HZ - FREQUENCY METER	UL UNDERWRITER LABORATORIES UON UNLESS OTHERWISE NOTED		
	UPS UNINTERRUPTIBLE POWER SUPPLY		
SPD SURGE PROTECTION DEVICE			
⊶ D ↓ LIGHTNING ARRESTOR	WP WEATHERPROOF		
NON FUSED SAFETY SWITCH	XFMR TRANSFORMER		
F J FUSED SAFETY SWITCH	1-PH SINGLE PHASE		
·	3-PH THREE PHASE		
MANUAL TRANSFER SWITCH WITH			
600A 3P		ITC	
BANK (CAM CONNECTIONS) & LOAD BANK (CAM CONNECTIONS) (TRIPLE SWITCH OR APPROVED EQUAL)		119	
	CONDUIT - EXPOSED		

GR	OUNDING
•	GROUND ROD
G	BARE COPPER CONDUCTOR EXPOSED
G ———	BARE COPPER CONDUCTOR BURIED OR EMBEDDED IN CONCRETE
GND	GROUND BUS
• TW	TEST WELL





UTILITY POLE

HANDHOLE

MANHOLE

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	~	U
	GENERAL POWER	GENERAL NOTES
c-	DENOTES MOUNTED 6" ABOVE COUNTER TOP	1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NFPA-70) AS ADOPTED AND AMMENDED BY PHILADELPHIA ELECTRICAL CODE AND
-0	SINGLE RECEPTACLE	THE THE COMMONWEALTH OF PENNSYLVANIA. 2. ALL ELECTRICAL WORK SHALL BE PROPERLY GROUNDED AND SHALL MEET ALL
=⊖ GE	DUPLEX RECEPTACLE, NEMA 5-20R	REQUIREMENTS OF THE APPLICABLE SECTION OF THE NATIONAL ELECTRICAL CODE (NEC) AND ANY AUTHORITIES HAVING JURISDICTION.
GFCI	GROUND FAULT CIRCUIT INTERRUPTER	3. DRAWINGS ARE DIAGRAMMATIC IN NATURE, THE CONTRACTOR SHALL VERIFY DIMENSIONS PRIOR TO INSTALLATION. CONTRACTOR SHALL COORDINATE ALL WITH OTHER
SWITC	HED ISOLATED GROUND	DIVISIONS TRADES TO PROVIDE A COMPLETE AND OPERATIONAL SYSTEM. CONTRACTOR SHALL COORDINATE LOCATION OF FIXTURES, DEVICES, ETC WITH OTHER TRADES IN ORDER TO AVOID INTERFERENCES.
S	SWITCHED	4. ARCHITECTURAL FEATURES SHOWN ON THESE DRAWINGS ARE FOR BACKGROUND
TR		ACTUAL BUILDING CONSTRUCTION WALLS AND CURBS. REFER TO EQUIPMENT DRAWINGS FOR ACTUAL LOCATION OF EQUIPMENT.
WP	WEATHER RESISTANT RECEPTACLE W/IN-USE COVER (WET LOCATION) WEATHER RESISTANT RECEPTACLE	5. EXACT CONDUIT STUB-UP LOCATIONS ARE TO BE DETERMINED BY THE ELECTRICAL CONTRACTOR BASED ON THE CERTIFIED MANUFACTURER'S DRAWINGS OF RESPECTIVE EQUIPMENT. CONDUITS SHALL BE INSTALLED TO AGREE WITH EQUIPMENT FURNISHED.
-	W/NON-IN-USE COVER (DAMP LOCATION)	6. WALL AND FLOOR PENETRATIONS SHALL BE BY THE ELECTRICAL CONTRACTOR. PROVIDE FIRESTOP AS REQUIRED FOR ALL PENETRATIONS MADE FOR ELECTRICAL WORK
- - TV-	RECEPTACLE FOR TV MONITOR	7. COORDINATE THE COLORS OF WIRING DEVICES AND FACEPLATES WITH THE ARCHITECT.
₩	DOUBLE DUPLEX RECEPTACLE	8. EQUIPMENT AND DEVICES SHALL MATCH THE BUILDING STANDARD.
-	DUPLEX RECEPTACLE DEDICATED FOR UPS POWER	
⊢€	SPECIAL PURPOSE RECEPTACLE (AMPACITY AS NOTED) A - 30A, 2 POLE + GROLIND 208VAC, 1-PHASE, NEMA 4X, ID66/ID67	
	B - 30A, 1POLE + NEUTRAL + GROUND, 125VAC, NEMA 4X, IP66/IP67 C - 30A, 3 POLE + GROUND, 208VAC, 3-PHASE, NEMA 4X, IP66/IP67	
	D - 60A, 3 POLE + GROUND, 208VAC, 3-PHASE, NEMA 4X, IP66/IP67 E - 30A, 2 POLE + GROUND, 250VAC, 1-PHASE, TWISTLOCK F - 30A, 1 POLE + NEUTRAL + GROUND, 125VAC, TWISTLOCK	A. UNLESS OTHERWISE NOTED ON THE DRAWINGS CONCRETE ENCASED AND DIRECT BURIED CONDUIT SHALL BE SCHEDULE 40 PVC. WHERE CONDUITS PASS THROUGH GRADE, THROUGH CONCRETE PADS, OR THROUGH BUILDING FOUNDATION WALLS OR ELOOR SLABS CONDUIT SHALL BE PVC COATED
	DUPLEX RECEPTACLE FLOOR MOUNTED	2. OUTDOORS A LINESS OTHERWISE NOTED ON THE DRAWINGS CONDUIT INSTALLED OUTDOORS SHALL
	SPECIAL PURPOSE RECEPTAGLE FLOOR MOUNTED (AMPACITY AS NOTED) SURFACE MOUNTED RACEWAY	BE GALVANIZED RIGID STEEL AND FLEXIBLE CONNECTIONS SHALL BE LIQUIDTIGHT FLEXIBLE METAL CONDUIT.
	LETTER INDICATES TYPE (SEE E600) NUMBER INDICATES LENGTH	 3. INDOORS A. IN FINISHED AREAS ALL RACEWAY AND WIRING SHALL BE CONCEALED AND BOXES RECESSES. WIRING INSTALLED IN MASONRY WALLS SHALL BE EMT OR GALVANIZED RIGID
J	JUNCTION BOX	STEEL. WIRING INSTALLED IN STUD WALL CAVITIES OR ABOVE HUNG CEILINGS MAY BE TYPE MC CABLE OR EMT. B IN UNEINISHED AREAS SUCH AS MECHANICAL AND ELECTRICAL ROOMS WIRING SHALL BE
	NON FUSED DISCONNECT SWITCH	INSTALLED IN EMT. C. WIRING IN THE CRAWLSPACE SHALL BE INSTALLED IN RIGID METAL CONDUIT.
F	FUSED DISCONNECT SWITCH	
\ge	MOTOR STARTER	
μ	COMBINATION MOTOR STARTER	
\sum	CONTACTOR	
TS	TIME CLOCK SWITCH CONTROL	
s _T	TIME SWITCH	
s _M	MANUAL MOTOR STARTER SWITCH WITHOUT OVERLOADS	
s _{MT}	MANUAL MOTOR STARTER SWITCH WITH THERMAL OVERLOADS	
s _{MF}	MANUAL MOTOR STARTER SWITCH WITHOUT OVERLOADS WITH PILOT LIGHT	
	PANELBOARD	
PB	PUSHBUTTON STATION TYPE AS NOTED	
	MUSHROOM SWITCH	
6	MOTOR (HORSEPOWER INDICATED ON PLANS)	
7 T	TRANSFORMER	
\bigcirc	GENERATOR	
	MOTOR OPERATED DAMPER	
T)	THERMOSTAT	
UPS	UNINTERRUPTIBLE POWER SUPPLY	
SPD	SURGE PROTECTION DEVICE	
	UNIT HEATER	
	VARIADLE FREQUENUT UKIVE	
	MISCELLANEOUS	
C-	COMMUNICATION	
——E-	ELECTRIC	
—-Е-	ELECTRIC SERVICE/DUCTBANK-	
——Т-	TELEPHONE	

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MECHANICAL / PL GANNETT FLEMING	<u>umbing engineer:</u> G, INC.
1010 ADAMS AVEN VALLEY FORGE, PA Phone: 610.783.38	NUE \ 19403 62
Email: BWEISSER@(Attn: BRIAN WEISSE	GFNET.COM ER
ISSUE	<u>ED FOR BID</u> /12/2021
<u></u>	<u>12/2021</u>
NO DATE SCHOOL & LOO	
NO DATE SCHOOL & LOO 1601 COTTMAN /	REVISION CATION AVE, PHILADELPHIA P. 19111
Image: Control of the second secon	REVISION CATION AVE, PHILADELPHIA P. 19111
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	REVISION CATION AVE, PHILADELPHIA P. 19111 ONING UPGRADE
Image: School & log Image: Schoo	REVISION CATION AVE, PHILADELPHIA P. 19111 ONING UPGRADE ONING UPGRADE
	REVISION CATION AVE, PHILADELPHIA P. 19111 ONING UPGRADE CAL SYMBOLS, ONS, & GENERAL NOTES
Image: Sector of the sector	REVISION CATION AVE, PHILADELPHIA P. 19111 ONING UPGRADE CAL SYMBOLS, ONS, & GENERAL JOTES
	REVISION REVISION CATION AVE, PHILADELPHIA P. 19111 ONING UPGRADE CAL SYMBOLS, ONS, & GENERAL NOTES ENGINEER'S PRJ. NO. 068625.001
Image: Second state sta	REVISION REVISION CATION AVE, PHILADELPHIA P. 19111 ONING UPGRADE CAL SYMBOLS, ONS, & GENERAL NOTES ENGINEER'S PRJ. NO. 068625.001 CHECKED BY
Image: Second state sta	REVISION REVISION CATION AVE, PHILADELPHIA P. 19111 ONING UPGRADE CAL SYMBOLS, ONS, & GENERAL NOTES ENGINEER'S PRJ. NO. 068625.001 CHECKED BY BAM
Image: Second state sta	REVISION REVISION CATION AVE, PHILADELPHIA P. 19111 ONING UPGRADE CAL SYMBOLS, ONS, & GENERAL NOTES ENGINEER'S PRJ. NO. 068625.001 CHECKED BY BAM
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25.001 Local File: BIM 360://063694 - School District of Philadelphia (R2020)/063694_SDP_NEHS_IDIQ_MEP_CENTRAL_R2







GENERAL NOTES:

- 1. SEE ELECTRICAL SHEET E001 FOR GENERAL NOTES AND WIRING METHODS.
- 2. ALL ELECTRICAL EQUIPMENT SHOWN ON DRAWING IS NEW UNLESS NOTED OTHERWISE.
- 3. ALL WIRING SHALL BE INSTALLED IN CONDUIT OF REQUIRED SIZE BUT NO SMALLER THAN SIZE INDICATED.
- 4. NOT ALL SHEET NOTES MAY BE USED ON THIS SHEET.
- 5. LABEL ALL NEW PANELS, SWITCHES AND RECEPTACLES.
- 6. COORDINATE EFFORTS WITH SDP-PROCURED COMMISSIONING AGENT. 7. INSTALL ALL DISCONECT SWITCHES FURNISHED BY MECHANICAL CONTRACTOR. PROVIDE CONDUIT AND WIRING THROUGH DISCONNECT SWITCHES TO EQUIPMENT.
- <u>SHEET NOTES: (#)</u>
- 1. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL NEW SINGLE SURFACE MOUNTED NEMA 6-15P WALL OUTLET WITHIN 12" MAX OF EXISTING WINDOW PANEL DESIGNATED FOR NEW AC UNIT. CONNECT TO A 20A, 2P CIRCUIT BREAKER IN NEW PANEL P2, LOCATED IN CORRIDOR 53. CONNECT WITH (2) #10, (1) #10GRD IN 3/4" CONDUIT. FURNISH AND INSTALL A 30A, 2-POLE, 250 VAC SNAP SWITCH FOR ON/OFF CONTROL OF AC UNIT. WIRE THROUGH SWITCH AND MAKE FINAL CONNECTION TO AC UNIT OUTLET.
- 2. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL NEW SINGLE SURFACE MOUNTED NEMA 6-20P WALL OUTLET WITHIN 12" MAX OF EXISTING WINDOW PANEL DESIGNATED FOR NEW AC UNIT. CONNECT TO A 20A, 2P CIRCUIT BREAKER IN NEW PANEL P2, LOCATED IN CORRIDOR 53. CONNECT WITH (2) #10, (1) #10GRD IN 3/4" CONDUIT. FURNISH AND INSTALL A 30A, 2-POLE, 250 VAC SNAP SWITCH FOR ON/OFF CONTROL OF AC UNIT. WIRE THROUGH SWITCH AND MAKE FINAL CONNECTION TO AC UNIT OUTLET.
- 3. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL NEW SINGLE SURFACE MOUNTED NEMA 6-30P WALL OUTLET WITHIN 12" MAX OF EXISTING WINDOW PANEL DESIGNATED FOR NEW AC UNIT. CONNECT TO A 30A, 2P CIRCUIT BREAKER IN NEW PANEL P2, LOCATED IN CORRIDOR 53. CONNECT WITH (2) #8, (1) #8GRD IN 3/4" CONDUIT. FURNISH AND INSTALL A 30Á, 2-POLE, 250 VAC SNAP SWITCH FOR ON/OFF CONTROL OF AC UNIT. WIRE THROUGH SWITCH AND MAKE FINAL CONNECTION TO AC UNIT OUTLET.
- 4. PROVIDE 30/2 CIRCUIT BREAKER FROM NEW PANEL P1. CONNECT WITH 2#10, (1) #10GRD IN 3/4" CONDUIT. ELECTRICAL CONTRACTOR SHALL INSTALL DISCONNECT SWITCH PROVIDED BY MECHANICAL CONTRACTOR. PROVIDE POWER AND CONTROL WIRING BETWEEN THE OUTDOOR UNIT AND ITS ASSOCIATED INDOOR UNIT(S) IN ACCORDANCE WITH THE SPLIT SYSTEM MANUFACTURER'S REQUIREMENTS.

<u>ISSUED FOR BID</u> 05/12/2021		
NO	DATE	REVISION
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PRO		ONING UPGR
PRC AIF DR	OJECT TITLE CONDITIC AWING TITLE ELECTRICA FLOOR P	ONING UPGR
PRC AIF DR DR AS 1	DJECT TITLE CONDITION AWING TITLE ELECTRICA FLOOR P	ONING UPGR
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PRC AIF DR DR LOC 8020 FJR	DJECT TITLE CONDITION AWING TITLE ELECTRICA FLOOR P	ONING UPGR L POWER FIRS LAN - SOUTH ENGINEER'S PRJ 068625.001 CHECKED BY BAM
PRC AIF DR DR AS 1 LOC 8020 FJR	AWING TITLE	ONING UPGR AL POWER FIRS LAN - SOUTH ENGINEER'S PRJ 068625.001 CHECKED BY BAM OF 2020/21 OF 2020/21 OF 2020/21
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ENGINEER OF RECORD: MECHANICAL / PLUMBING ENGINEER: GANNETT FLEMING, INC. 1010 ADAMS AVENUE VALLEY FORGE, PA 19403 Phone: 610.783.3862 Email: BWEISSER@GFNET.COM Attn: BRIAN WEISSER

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			GE	ENERAL NC	DTES:	
			1.	SEE ELECTRI	ICAL SHEET E001	FOR GENERAL NOTES AND WIRING METH
			2.	ALL ELECTRIC OTHERWISE.	CAL EQUIPMENT	SHOWN ON DRAWING IS NEW UNLESS NO
			3.	ALL WIRING S SMALLER TH	SHALL BE INSTAL AN SIZE INDICATI	LED IN CONDUIT OF REQUIRED SIZE BUT N ED.
			4.	NOT ALL SHE	ET NOTES MAY E	BE USED ON THIS SHEET.
			5.	LABEL ALL NE	EW PANELS, SWI	TCHES AND RECEPTACLES.
			6.	COORDINATE	EEFFORTS WITH	SDP-PROCURED COMMISSIONING AGENT
			7.	INSTALL ALL CONTRACTO SWITCHES TO	DISCONECT SWI R. PROVIDE CON O EQUIPMENT.	TCHES FURNISHED BY MECHANICAL IDUIT AND WIRING THROUGH DISCONNEC ⁻
			<u>S</u>	HEET NOTI	<u>ES:</u> (#)	
			1.	ELECTRICAL NEW SINGLE WITHIN 12" M FOR NEW AG BREAKER IN CONNECT W	L CONTRACTOR S E SURFACE MOU MAX OF EXISTING C UNIT. CONNEC I NEW PANEL P34 VITH (2) #10, (1) #1	SHALL PROVIDE AND INSTALL NTED NEMA 6-15P WALL OUTLET S WINDOW PANEL DESIGNATED T TO A 20A, 2P CIRCUIT A, LOCATED IN CORRIDOR 53. 10GRD IN 3/4" CONDUIT.
			2.	ELECTRICAL NEW SINGLE WITHIN 12" M FOR NEW AG BREAKER IN CONNECT W	CONTRACTOR S SURFACE MOUI MAX OF EXISTING UNIT. CONNEC I NEW PANEL P34 VITH (2) #10, (1) #1	SHALL PROVIDE AND INSTALL NTED NEMA 6-20P WALL OUTLET & WINDOW PANEL DESIGNATED T TO A 20A, 2P CIRCUIT A, LOCATED IN CORRIDOR 53. 10GRD IN 3/4" CONDUIT.
			3.	ELECTRICAL NEW SINGLE WITHIN 12" M FOR NEW AG BREAKER IN CONNECT W	CONTRACTOR S SURFACE MOU MAX OF EXISTING C UNIT. CONNEC I NEW PANEL P34 VITH (2) #8, (1) #80	SHALL PROVIDE AND INSTALL NTED NEMA 6-30P WALL OUTLET WINDOW PANEL DESIGNATED T TO A 30A, 2P CIRCUIT A, LOCATED IN CORRIDOR 53. GRD IN 3/4" CONDUIT.
			4.	PROVIDE 30, CONNECT W ELECTRICAL SWITCH PRO POWER AND UNIT AND IT WITH THE SI REQUIREME	/2 CIRCUIT BREAU VITH 2#10, (1) #100 CONTRACTOR S OVIDED BY MECH O CONTROL WIRIN S ASSOCIATED IN PLIT SYSTEM MAU ENTS.	KER FROM NEW PANEL P3A. GRD IN 3/4" CONDUIT. SHALL INSTALL DISCONNECT IANICAL CONTRACTOR. PROVIDE NG BETWEEN THE OUTDOOR NDOOR UNIT(S) IN ACCORDANCE NUFACTURER'S
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	GYMNASIUM 1 I54A					

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GENERAL NOTES:

- 1. SEE ELECTRICAL SHEET E001 FOR GENERAL NOTES AND WIRING METHODS.
- 2. ALL ELECTRICAL EQUIPMENT SHOWN ON DRAWING IS NEW UNLESS NOTED OTHERWISE.
- 3. ALL WIRING SHALL BE INSTALLED IN CONDUIT OF REQUIRED SIZE BUT NO SMALLER THAN SIZE INDICATED.
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- 5. LABEL ALL NEW PANELS, SWITCHES AND RECEPTACLES.
- 6. COORDINATE EFFORTS WITH SDP-PROCURED COMMISSIONING AGENT. 7. INSTALL ALL DISCONECT SWITCHES FURNISHED BY MECHANICAL CONTRACTOR. PROVIDE CONDUIT AND WIRING THROUGH DISCONNECT SWITCHES TO EQUIPMENT.

SHEET NOTES:

- 1. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL NEW SINGLE SURFACE MOUNTED NEMA 6-15P WALL OUTLET WITHIN 12" MAX OF EXISTING WINDOW PANEL DESIGNATED FOR NEW AC UNIT. CONNECT TO A 20A, 2P CIRCUIT BREAKER IN NEW PANEL P3B, LOCATED IN CORRIDOR 53. CONNECT WITH (2) #10, (1) #10GRD IN 3/4" CONDUIT.
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- 3. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL NEW SINGLE SURFACE MOUNTED NEMA 6-30P WALL OUTLET WITHIN 12" MAX OF EXISTING WINDOW PANEL DESIGNATED FOR NEW AC UNIT. CONNECT TO A 30A, 2P CIRCUIT BREAKER IN NEW PANEL P3B, LOCATED IN CORRIDOR 53. CONNECT WITH (2) #8, (1) #8GRD IN 3/4" CONDUIT.
- 4. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL NEW 400A, 208/120V, 3PH, 54P PANELBOARD TO PROVIDE POWER TO AC UNITS. INSTALL NEW PANEL P3A IN THE SPACE PREVIOUSLY OCCUPIED BY LOCKERS 201/14-19 (BY ROOM 252), AND NEW PANEL P3B IN THE SPACE PREVIOUSLY OCCUPIED BY LOCKERS 201/1-4 (BY ROOM 201). REFER TO BUILD OUT DETAIL ON E502. COORDINATE EXACT LOCATION WITH SDP PROJECT MANAGER PRIOR TO INSTALLATION OF PANEL.
- 5. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL NEW 12"x6" SURFACE MOUNTED J-BOX. INSTALL J-BOX ABOVE NEW PANEL. PROVIDE AND CONNECT A 2" EMPTY CONDUIT FROM THE FRONT OF NEW PANEL/WALL BUILD OUT TO THE NEW J-BOX.
- 6. PROVIDE 30/2 CIRCUIT BREAKER FROM NEW PANEL P3B. CONNECT WITH 2#10, (1) #10GRD IN 3/4" CONDUIT. ELECTRICAL CONTRACTOR SHALL INSTALL DISCONNECT SWITCH PROVIDED BY MECHANICAL CONTRACTOR. PROVIDE POWER AND CONTROL WIRING BETWEEN THE OUTDOOR UNIT AND ITS ASSOCIATED INDOOR UNIT(S) IN ACCORDANCE WITH THE SPLIT SYSTEM MANUFACTURER'S REQUIREMENTS.

1/E104



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	MECHANICAL / PLUMBING ENGINEER: GANNETT FLEMING, INC.
	1010 ADAMS AVENUE VALLEY FORGE, PA 19403 Phone: 610.783.3862 Emgil: BWEISSER@GENET COM
	Attn: BRIAN WEISSER
	<u>ISSUED FOR BID</u> 05/12/2021
	NO DATE REVISION
	SCHOOL & LOCATION 1601 COTTMAN AVE, PHILADFLPHIA PA
	19111
	PROJECT TITLE
	AIR CONDITIONING UPGRADE
	DRAWING TITLE
	ELECTRICAL POWER SECOND FLOOR PLAN - NORTH
	DRAWING SCALE
	DRAWN RY CHECKED RY
	FJR BAM
	MC - B-006 C OF 2020/21 EC - B-007 C OF 2020/21
	DRAWING NO.
-	SHEET 16 OF 18





440 NORTH BE	
	ROAD STREET
(215) 400 - 4730 (215) 400 - 4731 (fax)
SEAL:	
ENGINEER OF RECOF	RD:
MECHANICAL / PLUM GANNETT FLEMING, IN	BING ENGINEER: VC.
1010 ADAMS AVENUE VALLEY FORGE, PA 19 Phone: 610.783.3862	2403
Attn: BRIAN WEISSER	NET.COM
ISSUED	
<u>ISSUED</u> 05/12	<u>FOR BID</u> 2/2021
<u>ISSUED</u> 05/12	<u>FOR BID</u> //2021
<u>ISSUED</u> 05/12	FOR BID 2/2021
<u>ISSUED</u> 05/12	FOR BID 2/2021
<u>ISSUED</u> 05/12	FOR BID 2/2021
	FOR BID 2/2021
	FOR BID //2021
ISSUED 05/12	FOR BID //2021
ISSUED 05/12 05/12	FOR BID //2021
ISSUED 05/12 05/12	FOR BID 2/2021
ISSUED OS/12 O	FOR BID //2021
ISSUED 05/12 05/12	FOR BID 2/2021
ISSUED O5/12 O	FOR BID /2021
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ISSUED 05/12 05/12	FOR BID 2/2021
ISSUED 05/12<	FOR BID /2021 REVISION REVISION TION E, PHILADELPHIA 111 NING UPGRAI ANING UPGRAI
ISSUED 05/12 05/12	FOR BID 2/2021
ISSUED 05/12 05/12 05/12	FOR BID 2/2021 REVISION TION E, PHILADELPHIA 111 NING UPGRAI
ISSUED O5/12 O	FOR BID 2021 REVISION REVISION TION E, PHILADELPHIA 111 NING UPGRAI RTIAL EXISTIN E DIAGRAM
ISSUED OS/12 O	FOR BID 2/2021 FOR BID 2/2021 REVISION REVISION ING UPGRAI REVISION ING UPGRAI CHECKED BY BAM
ISSUED OS/12 O	FOR BID /2021 ENCINON REVISION REVISION TION E, PHILADELPHIA 111 NING UPGRAI REVISION ENGINEER'S PRJ. N 068625.001 CHECKED BY BAM
ISSUED O5/12 O5/12 O5/12 O5/12 O5/12 O5/12 O O O O O O O O O O O O O	FOR BID /2021 REVISION ING UPGRAI REVISION ING UPGRAI INING UPGRAI ENGINEER'S PRJ. N 068625.001 CHECKED BY BAM
ISSUED OS/12 O	FOR BID Z2021 REVISION REVISION TION E, PHILADELPHIA 111 NING UPGRAI REVISION CHECKED BY BAM OF 2020/21 OF 2020/21 OF 2020/21

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PM 88

(3) NEW PANEL P3A

	EVV 'F	PANEL P3A'	MAIN BUS RAT MAIN RATING:	FING: 400A 400A			PANEL MOUNTING: SURFACE PANEL ENCLOSURE (NEMA): 1 SHORT CIRCUIT: 22kAIC						
CIR.	CIR.	DESCI		WIDE	CROUND	CONDUIT	L	DAD - K	A		LC)AD - K\	/A
No.	BKR.	DESCH	RIPTION	WIRE	GROUND	CONDUIT	ФА	ΦВ	ФС	1	ФА	ΦВ	Φ
1	20/2	30/2 ACI 203		011 000		2//"	1.90			1	1.90		
3	30/2	A00-203		#10	#10	3/4		1.90				1.90	
5	20/2	ACU			#10	3/4"			1.40				1.9
7	20/2	////	200/1		10	0/-1	1.40				1.60		
9	30/2	ACL	J-213	#10	#10	3/4"		1.90				1.90	
11									1.90	4			1.9
13	20/2	ACU	-219A	#10	#10	3/4"	1.40	4.40		4	1.40	1.40	<u> </u>
15								1.40	0.50	-		1.40	
10	20/2	ACL	J-241	#10	#10	3/4"	0.50		0.50	-	1.00		1.8
21							0.50	1 40		1	1.90	1.40	
23	20/2	ACU	-221B	#10	#10	3/4"		1.40	1 40	1		1.40	14
25							1.40		1.10	1	1.90		
27	20/2	ACU	CU-223A #		#10	3/4"		1.40		1		1.90	
29			ACU-227A						1.40	1			1.4
31	20/2	ACU			#10	3/4"	1.40			1	1.40		
33	20/2		2200	#10	#10	2/4"		1.40		1		1.40	
35	20/2	ACU	-2290	#10	#10	3/4			1.40				1.4
37	20/2	ACI	1-231	#10	#10	3/4"	1.40				1.40		
39	20/2				10	0/-1		1.40				1.40	
41	20/2	ACL	J-235	#10	#10	3/4"			1.40	4			0.7
43						5/4	1.40			4	0.70		
45	30/2	SP	ARE	#10	#10	3/4"				4			
47										-			_
49 51										-			
53		SP								1			
55		SP	ACE							1			
57		SP	ACE							1			
59		SP	ACE							1			
61		SP	ACE							1			
63		SP	ACE							1			
65		SP	ACE							1			
	•	-			-	TOTAL	. 10.8	10.8	9.4	1	12.2	11.3	10
PANE ΦΑ ΦΒ ΦC	L CONN 23.0 22.1 20.0 65.1	IECTED LOAD	D TOTAL							X X X	SOLID EQUIPI INTEGF	NEUTR/ MENT G RAL SPI	AL B ROL)

TYPE: BRANCH CIRCUIT NUMBER OF POLES: 66 MAIN BUS RATING: 400A

(1) NEW PANEL P1

PANEL DESIGNATION

NEW PANEL



Α

В

С

D

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OF RE	2 53						
- K' 3	νA ΦC	CONDUIT	GROUND	WIRE	DESCRIPTION	CIR. BKR.	CIR. No.
0		3/4"	#10	#10	ACU-003	20/2	2 4
	0.70	3/4"	#10	#10	ACU-024	20/2	6 8
0	0.50	3/4"	#8	#8	ACU-033	30/2	10 12
0		3/4"	#8	#8	ACU-014	30/2	14 16
	1.40	3/4"	#10	#10	ACU-016A	20/2	18 20
0	1.90	3/4"	#8	#8	ACU-017B	20/2	22 24
0		3/4"	#10	#10	ACU-034	30/2	26 28
0	0.70	3/4"	#10	#10	ODU-009A	30/2	30 32
0		3/4"	#10	#10	ODU-18B	30/2	34 36
	0.70	3/4"	#10	#10	ODU-18C	30/2	38 40
		3/4"	#10	#10	SPARE	20/2	42 44
					SPACE		46 48
					SPACE		50
					SPACE		52
					SPACE		54
					SPACE		56
					SPACE		58
					SPACE		60
					SPACE		62
					SPACE		64
	5.0	TOTAL			SPACE		66
Γ Γ G SPI	al BUS ROUND	BUS					

NE	NEL D EW '	PANEL P2'	TYPE: BRANC NUMBER OF P MAIN BUS RAT MAIN RATING:	H CIRCUIT OLES: 66 ING: 400A 400A	_		LOCATI VOLTAG PANEL PANEL SHORT	ION: 1S GE: 208 MOUNT ENCLO CIRCU	ST FLOOF 3Y/120V, : FING: SU SURE (N IT: 22kAI	R CORRIDO 3-PHASE, 4 RFACE EMA): 1 C	DR 180 I-WIRE							
IR.	CIR. BKR	DESCR		WIRE	GROUND	CONDUIT	LC	DAD - K	VA C	LC	DAD - K	VA C	CONDUIT	GROUND	WIRE	DESCRIPTION	CIR. BKR	CI
1	20/2		100	#10	#10	2/4"	1.90	ΨD	ΨC	4 1.90	ΨΒ	Ψ	2///"	#10	#10		20/2	1
3	30/2	ACC	-109	#10	#10	5/4		1.90			1.90		5/4	#10	#10	ACO-100	30/2	
5	30/2	ACL	-108	#10	#10	3/4"			1.90			1.90	3/4"	#10	#10	ACU-110	30/2	
<u>_</u>							1.90	4.00		1.90	4.40							
1	30/2	ACL	-112	#10	#10	3/4"		1.90	1.00		1.40	1 40	3/4"	#10	#10	ACU-114	20/2	
3							1 40		1.90	1 40		1.40						
5	20/2	ACL	-116	#10	#10	3/4"		1.40			1.40		3/4"	#10 #10	#10	ACU-118 2	20/2	
	20/2		120.4	#10	#10	2/4"			0.50			1.90	2/4"	#10	#10	ACU 122	20/2	
	20/2	ACU:	120A	#10	#10	3/4	0.50			1.90			- 3/4	#10	#10	ACU-122	30/2	
	30/2	ACL	-124	#10	#10	3/4"		1.90			0.70		3/4"	#10	#10	ACU-126	20/2	
+							0.70		1.90	4.00		0.70						_
-	20/2	ACL	-134	#10	#10	3/4"	0.70	0.70		1.90	1.00		3/4"	#10	#10	ACU-138	30/2	
╉								0.70	0.70		1.30	0.70						
	30/2	ODL	I-101	#10	#10	3/4"	0.70		0.10	0.70		0.10	3/4"	#10	#10	ODU-120	30/2	
T	20/2		146	#10	#10	2/4"		0.70			1.50		2/4"	#10	#10		20/2	
	30/2		-145	#10	#10	3/4			0.70			1.50	3/4	#10	#10	NEW ARO	30/2	;
	20/2	SP	ARE	#10	#10	3/4"							3/4"	#10	#10	SPARE	30/2	
						•, •							•••		<i>"</i> .••			
-		SP	ACE										-			SPACE		<u> </u>
╀		SP	ACE													SPACE		
F		SP/														SPACE		
F		SP/	ACE													SPACE		-
F		SP	ACE													SPACE		
F		SP	ACE													SPACE		
		SP/	ACE													SPACE		
		SP	ACE													SPACE		
Τ		SP/	ACE													SPACE		(
		SP/	ACE													SPACE		(
		SP/	ACE													SPACE		(
		SP/	ACE													SPACE		(



	LOCAT VOLTA PANEL PANEL SHORT	ION: 2n GE: 208 MOUNT ENCLO	d FLOOI ;Y/120V, "ING: SI SURE (1 IT: 22kA	R C(3-P URF NEM	ORRIDO HASE, 4 ACE IA): 1	PR 270 I-WIRE							
Г	LC)AD - K\ ØB	/A		LC	DAD - K	/A	CONDUIT	GROUND	WIRE	DESCRIPTION	CIR. BKR.	CIR.
	••• 1.90	4 00	ΨC		••A 1.90	4 00	Ŷ	3/4"	#10	#10	ACU-205	30/2	2
	1.40	1.90	1.40		1.60	1.90	1.90	3/4"	#10	#10	ACU-211	30/2	4 6
	1.40	1.90	1.00		1.60	1.90	1.00	3/4"	#10	#10	ACU-217	30/2	8 10
	1.40	1.40	1.90		1.40	4.40	1.90	3/4"	#10	#10	ACU-219B	20/2	12
	0.50	1.40	0.50		1 00	1.40	1.90	3/4"	#10	#10	ACU-221A	30/2	18
	0.50	1.40	1.40		1.90	1.40	1.40	3/4"	#10	#10	ACU-223C	20/2	20
	1.40	1.40	1.40		1.90	1 90	1.40	3/4"	#10	#10	ACU-225	30/2	26
	1.40	1.40	1.40		1.40	1.50	1.40	3/4"	#10	#10	ACU-227B	20/2	30
	1.40	1.40	1 40		1.40	1.40	1 40	3/4"	#10	#10	ACU-229C	20/2	34
	1.40	1.40	1.40		1.40	1.40	1.40	3/4"	#10	#10	ACU-233	20/2	38
	1.40	1.40	1.40		0.70	1.40	0.70	3/4"	#10	#10	ODU-207A	30/2	42
	1.40				0.70			3/4"	#10	#10	SPARE	20/2	46
											SPACE	_	50
											SPACE		52
											SPACE		54
											SPACE		56
											SPACE		58
											SPACE		60
											SPACE		62
											SPACE		64
											SPACE		66
L	10.8	10.8	9.4		12.2	11.3	10.6	TOTAL			•		<u> </u>

11.3 10.6 7

D NEUTRAL BUS IPMENT GROUND BUS

		ESIGNATION								
N	EW 'F	PANEL '3B'	TYPE: BRAI NUMBER OF MAIN BUS R MAIN RATIN							
CIR. No.	CIR. CIR. DESCRIPTION BKR.									
1 3	20/2	SP	ARE							
5 7	20/2	ACL	J-202							
9 11	20/2	ACL	J-206							
13 15	20/2	ACL	J-210							
17 19	20/2	ACL	J-214							
21 23	20/2	ACL	J-218							
25 27	30/2	ACL	J-222							
29 31	20/2	ACU-234								
33	20/2	ACU-238								
37 39	20/2	ACL	J-242							
41	30/2	ODL	J-226							
45	30/2	SP	ARE							
49		SP/	ACE							
51		SP	ACE							
53		SP	ACE							
55		SP	ACE							
57		SP/	ACE							
59		SP/	ACE							
61		SP	ACE							
63		SP/	ACE							
05 PANE ΦΑ ΦΒ	L CONN 23.3 22.1 19.0	IECTED LOAD	4UE							
40	64.4	KVA CONNECTE	D TOTAL							
		•	-							



,		
6		

H C OLE ING 400	IRCUIT :S: 66 :: 400A)A			LOCAT VOLTA PANEL PANEL SHORT	ION: 2n GE: 208 MOUNT ENCLO CIRCU	d FLOO }Y/120V, `ING: SI SURE (I IT: 22k/	R CC , 3-PI URF/ NEM AIC)rrido Hase, 4 Ace A): 1	R 270 WIRE							
	WIRE	GROUND	CONDUIT	LC)AD - K\ 	/A ር	\square	LC)AD - KV	/A 	CONDUIT	GROUND	WIRE	DESCRIPTION	CIR. BKR.	CIR. No.
				1 40	Ψυ	ΨC	┥┟	1 40	ΨΒ	Ψυ						2
	#10	#10	3/4"	1.10	1.40		1	1.10	1.40		3/4"	#10	#10	ACU-200	20/2	4
	#10	#10	2//"			1.40	1			0.70	2//"	#10	#10	A CU 204	20/2	6
	#10	#10	3/4	1.40				0.70			3/4	#10	#10	AUU-204	2012	8
	#10	#10	3/4"		1.40				1.40		3/4"	#10	#10	ACU-208	20/2	10
\rightarrow				1 40		1.40		1.00		1.40						12
	#10	#10	3/4"	1.40	1.40			1.90	1.90		3/4"	#10	#10	ACU-212	30/2	14 16
			- / 411			1.40				1.90						18
	#10	#10	3/4"	1.40				1.90			3/4"	#10	#10	ACU-216	30/2	20
	#10	#10	2//"		1.40				1.40		2//"	#10	#10	ACU 220	20/2	22
	#10	#10	3/4			1.40] [1.40	3/4	#1U	#1U	AGU-220	20/2	24
	#10	#10	3/4"	1.90				1.90			3/4"	#10	#10	ACU-232	30/2	26
$ \rightarrow $			U , .		1.90				1.90		U , .		" • •		00, _	28
	#10	#10	3/4"	1 10		1.40		1.00	I	1.90	3/4"	#10	#10	ACU-236	30/2	30
				1.40	1 40		┤┟	1.90	1.00							32
	#10	#10	3/4"		1.40	1.40	┥╽		1.90	1 00	3/4"	#10	#10	ACU-240	30/2	34 36
-				1 40		1.40		1 90		1.90						30
	#10	#10	3/4"	1.40	1 40			1.50	1 90		3/4"	#10	#10	ACU-244	30/2	40
						0.70	1		1.00	0.70						42
	#10	#10	3/4"	0.70		•		0.70			3/4"	#10	#10	ODU-230	30/2	44
	#10	#10	2/4"								2/4"	#10	#10	ODADE.	20/2	46
	#10	#10	3/4] [3/4	<i>#</i> 10	#10	JPARE	20/2	48
] [SPACE		50
]							SPACE		52
														SPACE		54
														SPACE		56
										[SPACE		58
														SPACE		60
														SPACE		62
														SPACE		64
							1							SPACE		66
			TOTAL	11.0	10.3	9.1] [12.3	11.8	9.9	TOTAL					

X SOLID NEUTRAL BUS X EQUIPMENT GROUND BUS X INTEGRAL SPD

OFF		A D E L P H I / ITAL PROGRAMS
	440 NORTH PHILADELPHIA	BROAD STREET 5, PA 19130 - 4015
	(215) 400 - 4730 www	(215) 400 - 4731 (fax) philasd.org
SE	AL:	
EN	GINEER OF REC	ORD:
<u>ME</u> GA	CHANICAL / PLU	Imbing Engineer: , INC.
VA Pho Em	LLEY FORGE, PA DNe: 610.783.386	2 ENELCOM
Att	n: BRIAN WEISSE	R
	<u>ISSUE</u>	D FOR BID
	<u>ISSUE</u> <u>05/</u>	<u>D FOR BID</u> 12/2021
	<u>ISSUE</u> 05/	D FOR BID 12/2021
	LISSUE 05/	D FOR BID 12/2021
	ISSUE 05/	D FOR BID 12/2021
NO SC 1601	ISSUE 05/	D FOR BID 12/2021
NO SC 1601	ISSUE 05/	D FOR BID 12/2021
NO SC 1601		D FOR BID 12/2021
NO SC 1601	ISSUE 05/	D FOR BID 12/2021
		D FOR BID 12/2021
		D FOR BID 12/2021
		D FOR BID 12/2021
NO SC 1601 PRO All	ISSUE 05/	D FOR BID 12/2021 REVISION CATION VE, PHILADELPHIA F 9111 DNING UPGRAD
NO SC 1601 PRO All	ISSUE 05/	D FOR BID 12/2021 REVISION CATION VE, PHILADELPHIA F 9111 DNING UPGRAD
		D FOR BID 12/2021 REVISION REVISION CATION VE, PHILADELPHIA F 9111 DNING UPGRAD
 		D FOR BID 12/2021 REVISION CATION VE, PHILADELPHIA F 9111 DNING UPGRAD
	ISSUE 05/ 05/ 05/ 05/ 05/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01	D FOR BID 12/2021 REVISION REVISION CATION VE, PHILADELPHIA F 9111 DNING UPGRAD
Image: No		D FOR BID 12/2021 REVISION CATION VE, PHILADELPHIA F 9111 DNING UPGRAD
Image: Constraint of the second se	ISSUE 05/ 05/ 05/ 05/ 05/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01	D FOR BID 12/2021 REVISION REVISION CATION VE, PHILADELPHIA F 9111 DNING UPGRAD SCHEDULES AND 9111 DNING UPGRAD
Image: Constraint of the second se	ISSUE 05/ 05/ 05/ 05/ 05/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01	D FOR BID 12/2021
Image: Constraint of the second se	ISSUE 05/ 05/ 05/ 05/ 05/ 05/ 05/ 05/ 05/ 05/	D FOR BID 12/2021
Image: Control of the second secon	ISSUE 05/ 05/ 05/ 05/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01/ 01	D FOR BID 12/2021
Image: Constraint of the second se		D FOR BID 12/2021 REVISION ATION VE, PHILADELPHIA F 9111 DNING UPGRAD SCHEDULES AND 9111 ENGINEER'S PRJ. NO 068625.001 CHECKED BY BAM
Image: Constraint of the second se		D FOR BID 12/2021
Image: Constraint of the second se	ISSUE 05/ DATE DATE DATE DATE DATE CONDITIC COTTMAN A CONDITIC RCONDITIC RCONDITIC RCONDITIC RCONDITIC AWING SCALE NOTED CATION NO. O AWN BY MC - B-006 C EC - B-007 C	DFOR BID 12/2021