



REQUEST FOR QUOTATION – THIS IS NOT AN ORDER

RFQ # 260304

**ELECTRICAL CONSTRUCTION FOR LABORATORY REFRIGERATOR POWER
KLI SCIENCE CENTER, ALLEGHENY CAMPUS, LEGACY WAY, PITTSBURGH, PA 15212**

Please bid on the following and e-mail your reply to Mike Cvetic at mcvetic@ccac.edu **no later than Wednesday, March 4, 2026**

A mandatory pre-bid and site visit will be held at 9:00 a.m. on Thursday, February 26, 2026. Meet at the front entrance to the KLI Science Center, Allegheny Campus, Legacy Way, Pittsburgh, PA 15212.

An insurance certificate as described on “Form B” (attached) must be submitted by the awarded vendor prior to any service being performed.

For questions, contact Regis Fate at 412-237-2517 or rfate@ccac.edu

Payment terms: net 30 after completion and acceptance of invoice by CCAC. Vendor must be willing to invoice CCAC and allow 30 days for payment.

Please include:

- Anticipated start date _____
- Estimated duration of work _____

Pricing should include all labor, materials, equipment, supervision, and incidental costs necessary to complete the work.

Lump Sum Bid \$ _____

Bidder's Name: _____

Company Name: _____

Phone: _____

COMMUNITY COLLEGE OF ALLEGHENY COUNTY
800 ALLEGHENY AVENUE PITTSBURGH, PA 15233

INSURANCE REQUIREMENTS

FORM B

Indemnification. To the fullest extent permitted by law, Contractor shall defend, indemnify and hold harmless the Community College of Allegheny County (CCAC), its agents, officers, employees, and volunteers from and against all claims, damages, losses, and expenses (including but not limited to attorney fees and court costs) arising from the acts, errors, mistakes, omissions, work or service of Contractor, its agents, employees, or any tier of its subcontractors in the performance of this Contract. The amount and type of insurance coverage requirements of this Contract will in no way be construed as limiting the scope of indemnification in this Paragraph.

Insurance. Contractor shall maintain during the term of this Contract insurance policies described below issued by companies licensed in Pennsylvania with a current A.M. Best rating of A- or better. At the signing of this Contract, and prior to the commencement of any work, Contractor shall furnish the CCAC Purchasing Department with a **Certificate of Insurance** evidencing the required coverages, conditions, and limits required by this Contract at the following address: Community College of Allegheny County, Purchasing Department, 800 Allegheny Avenue, Pittsburgh, PA 15233.

The insurance policies, except Workers' Compensation and Professional Liability, shall be endorsed to name Community College of Allegheny County, its agents, officers, employees, and volunteers as Additional Insureds with the following language or its equivalent:

Community College of Allegheny County, its agents, officers, employees, and volunteers are hereby named as additional insureds as their interest may appear.

All such Certificates shall provide a 30-day notice of cancellation. Renewal Certificates must be provided for any policies that expire during the term of this Contract. Certificate must specify whether coverage is written on an Occurrence or a Claims Made Policy form.

Insurance coverage required under this Contract is:

- 1) **Commercial General Liability** insurance with a limit of not less than \$1,000,000 per occurrence for bodily injury, property damage, personal injury, products and completed operations, and blanket contractual coverage, including but not limited to the liability assumed under the indemnification provisions of this Contract.
- 2) **Automobile Liability** insurance with a combined single limit for bodily injury and property damage of not less than \$1,000,000 each occurrence with respect to Contractor's owned, hired, and non-owned vehicles.
- 3) **Workers' Compensation** insurance with limits statutorily required by any Federal or State law and **Employer's Liability** insurance of not less than \$100,000 for each accident, \$100,000 disease for each employee, and \$500,000 disease policy limit.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

PROJECT TABLE OF CONTENTS

DIVISION 7 -- THERMAL AND MOISTURE PROTECTION

078443 JOINT FIRESTOPPING

DIVISION 26 -- ELECTRICAL

260500 COMMON WORK RESULTS FOR ELECTRICAL
260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
262416 PANELBOARDS
262726 WIRING DEVICES
262816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

END OF TABLE OF CONTENTS

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Joints in or between fire-resistance-rated constructions.
 - 2. Joints at exterior curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
 - 1. Products manufactured by STI
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E2307.
 - 1. Products manufactured by STI
 - 2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

- D. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 - 1. Products manufactured by STI.
 - 2. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.
- E. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 078443

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. General administrative and procedural requirements.
 - 2. Electrical demolition.
 - 3. Cutting and patching for electrical construction.
 - 4. Touch-up Painting.
 - 5. Joint Sealers.

1.3 PARTIAL SCOPE

- A. This partial scope is intended to provide general project highlights – this partial scope is not comprehensive nor all inclusive. This contractor must visit the building and observe existing conditions – this contractor shall document and make owner aware of any condition which may affect his/her work. Failure to document and submit in writing to owner any condition which may affect contractors work does not excuse contractor from completing this installation. This contractor must review the entire document set prior to submitting his/ her bid.
- B. This project includes but is not limited to providing a new panel, receptacles and circuits for the receptacles.
- C. Maintaining existing raceways and wiring is a part of this project.
- D. The electrical contractor shall serve as the "prime" for the purposes of these documents. The electrical contractor shall remove ceiling tiles; provide penetrations as required; patch and paint upon substantial completion.

1.4 GENERAL STIPULATIONS

- A. The contractor shall procure all necessary permits to carry out their work. They shall also arrange for all tests required on any and all parts of their work by local authorities, paying all regular and proper charges for same. They shall also obtain all certificates of inspection and approval from all required authorities and the Underwriters. Underwriters' certificates in duplicate shall be furnished to the owner at the completion of the project. Also, the contractor shall furnish two copies of each intermediate Underwriters' inspection report to the Architect and the owner. All fees and permits required shall be satisfied and obtained by the contractor and the cost shall be included in the contract price.
- B. When the installation is reported in writing by the Contractor to be complete and ready for acceptance, tests and inspection shall be made by the Contractor in the presence of representatives of the Architect to ascertain whether it complies with the specifications and Contract, and upon its failure to do so, the Contractor shall at once remedy all defects and shortcomings, and any additional tests that may be required shall be entirely at the Contractor's expense.
- C. The Contractor shall have a managerial representative at each and every regularly scheduled job conference to receive the items that are furnished by owner, to inventory them and coordinate his work with the other trades.
- D. This Contractor shall be entirely responsible for all apparatus, equipment, and appurtenances furnished under this Contract in connection with the work, and special care shall be taken to protect all parts thereof in such a manner as may be necessary or as may be directed. Protection shall include covers, crating, sheds, or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment. Special care shall be taken to keep all open ends of conduit and other equipment closed while in storage and during the course of installation. Where equipment must be stored outside the building, it shall be totally covered and secured with heavy waterproof tarps and kept dry at all times. Where equipment has been subjected to moisture, it shall be suitably dried out before placed in service. All apparatus, equipment, conduit and other appurtenances shall be stored in areas designated by the Architect.
- E. The Contractor shall be responsible for coordinating with all Utility Companies that will provide services to this job site. This Contractor shall communicate with each and every public utility company and incorporate into this project's scope of work all Utility requirements for this project. This shall include, but not be limited to, all working clearances, fees, materials, equipment, conduits, conductors, service charges, etc.

1.5 DEFINITIONS

- A. Approved Equal: The term "approved equal", "approved", "equal", "equivalent", etc. shall mean equal in all respects in the opinion of the Architect.
- B. As Required: The term "as required" refers to making final connections to and/or coordinating with the appropriate authorities regarding the installation of the indicated equipment.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- C. Contractor: The term "Contractor", "this Contractor" or "Electrical Contractor" when used in the Contract Documents refers to the Contractor responsible for all work specified in Division 26 and as indicated on the Electrical Drawings.
- D. Directed: Terms such as "directed," "requested," "authorized," "selected," and "permitted" when used separately without referencing any authority, shall mean directed by the Architect, requested by the Architect, and similar phrases.
- E. Disconnect: Disconnect electrical service to indicated items. Associated conduit and wire shall be disconnected and removed, complete, back to its source. Where electrical equipment (e.g. generator) is connected to radiator, fuel, and exhaust piping, intake and exhaust ductwork, etc., this Contractor shall disconnect and remove all associated appurtenances, complete, back to their source unless noted otherwise.
- F. Existing to Remain: Protect construction and/or indicated items to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.
- G. Finished/Unfinished Space: The term "finished space" shall mean areas where drywall is hung and installed with wall coverings and/or painted, floors are polished or coverings are installed on the floor, and the ceiling is plaster/gypsum board and/or suspended A.C.T. The term "unfinished space" refers to any area that does not meet the definition for a "finished space" as specified above. Mechanical rooms, electrical rooms, garages, etc. are typically considered "unfinished spaces".
- H. Furnish: The term "furnish" when used separately, shall mean to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations by others.
- I. Indicated: The term "indicated", "shown," "noted," "scheduled," and "specified" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents.
- J. Install: The term "install" when used separately, shall mean to mount in place, connect and make operable. Installation operations at the Project site shall include, but not be limited to, the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- K. Provide: The term "provide" when used in these specifications, shall mean to furnish and install, complete and ready for the intended use. See above definitions for additional requirements.
- L. Regulations: The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- M. Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

- N. Remove: Remove and legally dispose of items except those indicated to be reinstalled or salvaged or to remain the Owner's property as directed.
- O. Salvage (Turn Over to Owner): Items indicated to be salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.
- P. Subcontractor: The term "Subcontractor" when used in these Contract Documents refers to an experienced installer (i.e. manufacturer, vendor, etc.) whom has successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction. Any reference to, or letting of work contained in these Contract Documents to any Subcontractor does not relieve this Contractor of his/her responsibility for all work, material and equipment indicated in these Contract Documents.
- Q. Work: The term "work" refers to all labor and materials provided by the Contractor and/or Subcontractor to make a complete and operable system.

1.6 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and as indicated below.
 - 1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 - 2. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 - 3. Do not submit Product Data on the following items and/or systems until compliance with requirements of the Contract Documents has been confirmed. See "Substitutions" article specified elsewhere in Part 1 for the Compliance Report requirements.
- B. If the Contractor submits a product of a manufacturer which appears as *a second or third name without corresponding catalog numbers and/or the manufacturer is not listed by name*, the submittal shall include a Compliance Report. See "Substitutions" article specified elsewhere in Part 1 for the Compliance Report requirements and additional substitution requirements.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- C. All drawings, etc., submitted for approval shall be marked with the name of the project and shall bear the stamp of approval of the Contractor as evidence that the material has been checked by the Contractor. Any drawings, etc., submitted without this stamp of approval will not be considered and will be returned to the Contractor for resubmission.
- D. Additional copies may be required by individual sections of these Specifications.
- E. None of the items throughout the electrical specifications which require a submission and/or review, shall be installed in the work or orders placed for same until final review has been given by the Architect.
- F. Submit product data for the following products:
 - 1. Panel board.
 - 2. Wiring.
 - 3. Conduit.
 - 4. Circuit breakers.
 - 5. Junction boxes and other raceway accessories.
 - 6. Access panels and doors.
 - 7. Devices.
- G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Control" article of this Section.
- H. Selective Demolition
 - 1. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut off of electrical service, and details for dust and noise control.
 - a. Coordinate sequencing with construction phasing and Owner occupancy as directed.
 - 2. Inventory of items removed and salvaged by the Contractor for the Owner for inclusion in the Operation and Maintenance Manuals.
 - 3. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.
 - 4. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."
 - a. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.7 SUBSTITUTIONS

- A. General: In order to establish standards of quality and performance, all types of materials listed hereinafter by manufacturer's names and/or manufacturer's catalog number shall be provided as specified. If this Contractor desires to substitute an item, he/she shall comply with the following administrative and procedural requirements which are included in this Section to expand the requirements as defined by Part 1 paragraph "Related Documents".
- B. Substitutions will be permitted only on products specified with the phrase "or approved equal", "or as approved", "or equal", "or equivalent", etc. and the burden shall be upon the bidder to prove such equality. If the Contractor elects to prove such equality, he/she must request the Architect's approval in writing to substitute such item for the specified item, and shall submit supporting data, and samples if required, to permit a fair evaluation of the proposed substitution with respect to quality, serviceability and warranty.
1. Samples: When requested, samples of items that the Contractor proposes to use as substitutions for the specified products/systems shall be submitted as follows.
 - a. A sample of both the specified item and the proposed substitute item shall be submitted simultaneously. The scheduling of the submission of such samples shall be as directed and shall in no way delay the progress of the Project.
 - b. Fixtures shall be submitted complete with lamps and a line cord ready for temporary operation.
 - c. The Architect will assume no responsibility whatsoever for any samples submitted.
- C. When the phrase "or approved equal", "or as approved", "or equal", "or equivalent", etc. appears and the Contractor desires to furnish equipment of a manufacturer other than that specified or intended, he/she shall include a complete specification of the substituted item, along with each submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the Contract Documents.
1. Compliance Report: Along with each submission copy of the product data and/or shop drawing, the manufacturer shall indicate the necessary modifications to the product and/or system to satisfy the requirements of the Contract Documents. Each paragraph including all subparagraphs shall bear the same paragraph number as the contract specification so that a close comparison can be made to the manufacturer specified herein by catalog number(s).
 2. Each paragraph for the substituted product/system shall be identified as follows:
 - a. Comply: The term "comply" shall only be used when the product/system indicated by the paragraph is completely equal in all respects to the type of material used, functionality, programmability, size, accessories to be provided, future capabilities, mounting, etc. to that which was specified. Anything less is not to be considered as complying and shall not be indicated as "Comply".

- b. Exception: The term “exception” shall be used when the product/system indicated by the paragraph does not meet the definition of “comply” as indicated above. The manufacturer shall provide a brief, clear and non-technical description of why the product/system does not meet the requirements of the specification and why it is not necessary to provide the specified materials, components, features, etc.
 - c. Deviate: The term “deviate” shall be used when the product/system indicated in the paragraph does not fully comply but the manufacturer is willing to provide all the necessary materials, components, features, accessories, future capabilities, etc. to meet the intent of the Contract Documents as determined by the Architect. The manufacturer shall provide a brief, clear and non-technical description of what additional items are to be provided and how these items affect the product/system.
3. Compliance report may be submitted prior to the submission of the substituted product data and/or shop drawings but the Architect reserves the right to request that certain product data, shop drawings, wiring diagrams, certificates, etc. be included as requested.
- D. All costs involved in changes in the building, to the equipment, to the arrangement of equipment, or to the work performed or to be performed under other sections of the specifications, due to the substitution of equipment in lieu of that shown on the drawings or specified, shall be borne by the Contractor making such substitutions, and shall include, but not necessarily be limited to, costs or fees in connection with resubmission of drawings for approval, if required, by the Authority Having Jurisdiction, local authorities or insuring agencies having jurisdiction over the work.

1.8 REGULATIONS

- A. All laws, ordinances, rules and regulations of public bodies bearing on the conduct of the work are hereby incorporated and made a part of these specifications.
- 1. Americans with Disabilities Act.
 - 2. Pennsylvania Uniform Construction Code / International Building Code to include the IECC.
 - 3. City and Local Codes.
 - 4. National Fire Protection Association (NFPA), i.e. National Electric Code - NFPA 70, Electrical Safety in the Workplace – NFPA 70E, National Fire Alarm Code – NFPA 72, Life Safety Code - NFPA 101 and Emergency and Standby Power Systems – NFPA 110.
 - 5. National Electrical Safety Code - ANSI C2.
 - 6. Owner's insuring agency.
- B. The Contractor shall comply with all rules, regulations and recommendations of any public utility serving this project.
- C. The entire electrical system shall be installed in accordance with the latest edition of the National Electrical Code, approved by the governmental body having jurisdiction, including amendments thereto.

1.9 DRAWINGS AND SPECIFICATIONS

- A. The drawings are generally diagrammatic and indicative of the work to be installed. Exact locations of equipment and points of termination shall be reviewed with the Architect. Should it be found that any system or equipment cannot be installed as shown on the drawings, the Architect shall be consulted before installing or making changes to the layout.
- B. The drawings and specifications are intended to function as a common set of documents. Anything shown on the drawings but not in the specifications, or mentioned in the specifications and not shown on the drawings, shall be equally binding as if both noted on the drawings and called for in the specifications.
- C. No measurement of a drawing by scale shall be used as a working dimension. Working measurements shall be taken from figured dimensions and through cooperation with all other Contractors.
- D. This Contractor shall carefully examine the Architectural, Structural, HVAC, Plumbing and Miscellaneous Contract Drawings and Specifications. If any discrepancies occur between the drawings or between the drawings and specifications, the discrepancies shall be reported to the Architect in writing and obtain written instructions as to the manner in which to proceed. No departures from the Contract Drawings shall be made without prior written instructions from the Architect.
- E. All items of labor, material and equipment not specified in detail or shown on the drawings but incidental to or necessary for the complete and proper installation and proper operation of the several branches of the work described herein or reasonably implied in connection therewith, shall be furnished as if called for in detail by the specifications or drawings.

1.10 FAMILIARITY WITH CONTRACT REQUIREMENTS

- A. It is the responsibility of the Contractor, prior to submitting a bid on this Project, to satisfy himself as to the nature and location of the work, the conformation of the ground, soil characteristics, the character, quality and quantity of the materials which will be required, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and of all other matters which can in any way affect the work under this Contract.
- B. Failure to make an on-site inspection prior to submitting a bid, or failure to comply with any or all of the above requirements will not relieve this Contractor from the responsibilities of properly estimating the requirements or costs of successful completion of the work nor from the responsibility for the faithful performance of the provisions of this Contract.
- C. The Electrical Contractor shall confer with all other Contractors and shall apply for detailed and specific information regarding the location of all equipment as the final location may differ from that indicated on the drawings. Outlets, equipment or wiring improperly placed because of the Electrical Contractor's failure to obtain this information shall be relocated and reinstalled by the Electrical Contractor without additional expense to the Owner.

1.11 COORDINATION DRAWINGS:

- A. Coordination drawings shall be initiated by the contractor responsible for the installation. This contractor shall indicate, on the architectural floor plans, equipment locations and dimensions drawn to scale, taking into consideration and incorporating proper clearances. All discrepancies and conflicts with the architectural layout of the building shall be noted on the coordination drawings. The contractor who initiated the coordination drawings shall submit them for review. Coordination and installation of any equipment not indicated on the coordination drawing shall be the responsibility of the contractor responsible for that equipment. Any modifications required by any contractor for equipment to be installed that is not shown on the coordination drawing shall be the responsibility of the contractor who failed to indicate that equipment.
1. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 4. Equipment and accessory service connections and support details.
 5. Fire-rated wall and floor penetrations.
 7. Sizes and location of required concrete pads and bases.
 8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 9. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.
- B. Electronic Files: Provide electronic files of all shop drawings and coordination drawings in AutoCAD 2018 format or later version. Also provide drawings in a PDF format.

1.12 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements as defined by Part 1 paragraph "Related Documents" and the following:
- B. Markup Procedure: During construction, maintain a set of blue or black line white prints of Contract Drawings and Shop Drawings for Project Record Document purposes.
1. Mark these Drawings to show the actual installation where the installation varies from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to, the following:
 - a. Revisions to details shown on the Drawings.
 - b. Locations and depths of all underground utilities and underslab conduits.
 - c. Locations of interior conduits larger than 2" diameter not installed underslab.
 - d. Locations of all feeder conduits.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- e. Revisions to Branch and Feeder Circuits: Record circuit numbers and associated panelboard space numbers for all existing, new, or relocated electrical appurtenances, mechanical equipment, owner furnished equipment, etc. that required power or reconnection of existing electrical services. Each circuit number shall be shown with a homerun coming off the equipment it serves. Circuit numbers indicated on the record drawings shall match the new or updated panelboard indexes.
 - f. Actual installed equipment locations.
 - g. Changes made by change order, Architect's written orders, and Owner requested.
2. Mark record sets with red erasable colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 3. Mark important additional information that was either shown schematically or omitted from original Drawings.
 4. Note Construction alternate numbers, change order numbers, and similar identification.
 5. Accurately record information in an understandable drawing technique.
 6. Record data as soon as possible after obtaining it. Record and check the markup prior to enclosing concealed installations.
 7. At time of Substantial Completion, submit record drawings to the Architect for the Owner's records. Organize into sets and bind and label sets for the Owner's continued use.
- C. Copies and Distribution: After completing the record drawings, print/copy 3 blue or black line prints of each drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with durable paper cover sheets. Include appropriate identification, including titles, dates, and other information on the cover sheets.
1. Organize and bind original marked up set of prints that were maintained during the construction period in the same manner.
 2. Submit the marked-up record set and a minimum 3 copy sets to the Architect for the Owner's records. Should more copies be requested by the Architect, they shall be provided at no cost to the Owner.

1.13 OPERATION MAINTENANCE MANUALS

- A. General: Prepare maintenance manuals in accordance with Part 1 paragraph "Related Documents" and the following:
- B. Form of Submittal: Prepare operation and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.
 1. Binders: For each manual, provide heavy duty, commercial quality, 3 ring, vinyl covered, loose leaf binders, in thickness necessary to accommodate contents, sized to receive 8 1/2 by 11 inch paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- a. Where two (2) or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
 - b. Identify each binder on front and spine, with the printed title "ELECTRICAL OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter covered. Indicate volume number for multiple volume sets of manuals.
2. Dividers: Provide heavy paper dividers with celluloid covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.
 3. Protective Plastic Jackets: Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
 4. Text Material: Where maintenance manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, neatly typewritten, on 8 1/2 by 11 inch, 20 lb/sq. ft. white bond paper.
 5. Drawings: Where maintenance manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings and bind in with text.
 - a. Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.
 - b. If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents, and drawing location at the appropriate location in the manual.

C. Manual Content

1. In each manual include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:
 - a. General system or equipment description.
 - b. Design factors and assumptions.
 - c. Copies of all approved Shop Drawings and Product Data, including products/systems installed during construction by change order, etc.
 - d. System or equipment identification, including:
 - 1) Name of manufacturer.
 - 2) Model number.
 - 3) Serial number of each component.
 - e. Operating instructions.
 - f. Emergency instructions.
 - g. Wiring diagrams.
 - h. Inspection and test procedures.
 - i. Inspection reports and certificates.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- j. Maintenance procedures and schedules.
 - k. Precautions against improper use and maintenance.
 - l. Copies of warranties.
 - m. Repair instructions including spare parts listing.
 - n. Sources of required maintenance materials and related services.
 - o. Manual index.
2. Organize each manual into separate Sections for each piece of related equipment. As a minimum, each manual shall contain a title page; a table of contents; copies of Product Data, supplemented by Drawings and written text; and copies of each warranty, bond, and service contract issued.
- a. Title Page: Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following information:
 - 1) Subject matter covered by the manual.
 - 2) Name and address of the Project.
 - 3) Date of submittal.
 - 4) Name, address, and telephone number of the Contractor.
 - 5) Name and address of the Architect.
 - 6) Cross reference to related systems in other operation and maintenance manuals.
 - b. Table of Contents: After title page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.
 - 1) Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.
 - c. General Information: Provide a general information Section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the Subcontractor or Manufacturer and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. Include a local source for replacement parts and equipment.
 - d. Product Data: Where the manuals include manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- e. **Written Text:** Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.
- f. **Drawings:** Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to assure correct illustration of the completed installation.
 - 1) Do not use original project record documents as part of operation and maintenance manuals.
- g. **Warranties, Bonds, and Service Contracts:** Provide a copy of each warranty, bond, or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of warranty or bond.
- h. **Approval letters from the following:**
 - 1) Local authority having jurisdiction
 - 2) Inspection agency
 - 3) Field representative for specific systems, e.g. fire alarm, signal/communication, intrusion detection, VFD, etc.

D. Electrical Maintenance Manual

- 1. **Equipment and Systems:** Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.
 - a. **Description:** Provide a complete description of each unit and related component parts, including the following:
 - 1) Equipment or system function.
 - 2) Operating characteristics.
 - 3) Limiting conditions.
 - 4) Performance curves.
 - 5) Engineering data and tests.
 - 6) Complete nomenclature and number of replacement parts.
 - b. **Manufacturer's Information:** For each manufacturer of a component part or piece of equipment, provide the following:
 - 1) Printed operation and maintenance instructions.
 - 2) Assembly drawings and diagrams required for maintenance.
 - 3) List of items recommended to be stocked as spare parts.

- c. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:
 - 1) Routine operations.
 - 2) Troubleshooting guide.
 - 3) Disassembly, repair, and reassembly.
 - 4) Alignment, adjusting, and checking.
 - d. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
 - 1) Startup procedures.
 - 2) Equipment or system break in.
 - 3) Routine and normal operating instructions.
 - 4) Regulation and control procedures.
 - 5) Instructions on stopping.
 - 6) Shutdown and emergency instructions.
 - 7) Summer and winter operating instructions.
 - 8) Required sequences for electric or electronic systems.
 - 9) Special operating instructions.
 - e. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
 - f. Controls: Provide a description of the sequence of operation and as installed control diagrams by the control manufacturer for systems requiring controls.
 - g. Circuit Directories: For electric and electronic systems, provide complete typewritten circuit directories of panelboards, including the following:
 - 1) Electric service.
 - 2) Controls.
 - 3) Communication.
- E. In addition to the number of maintenance manuals referenced in the "Related Documents" paragraph, prepare one (1) additional copy to be kept by the Engineer.

1.14 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. Labels and Listings: "Labels and Listings" for appliances and equipment provided meet the requirements of the Underwriters Laboratories, Inc. (UL), Electrical Testing Laboratories (ETL) and other standards organizations.
- C. Seismic Requirements: Provide equipment anchoring and support to resist shear and overturning moments.

D. Current Models:

1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
2. Replacement parts shall be available.
3. There shall be a permanent service organization maintained or trained by the manufacturer to provide satisfactory service.

E. Experience: Manufactured items shall have been installed and used, without modification, renovation or repair, on other projects for not less than three years prior to the date of bid opening for this project.

F. All work shall be installed in a first class, neat and workmanlike manner by mechanics skilled in the trade involved. The quality of workmanship shall be subject to the approval of the Architect. Any work found by the Architect to be of inferior quality and/or workmanship shall be replaced and/or reworked until approval of the Architect is obtained. Any cost involved in obtaining said approval shall be the responsibility of the Electrical Contractor.

1.15 CONTINUITY OF SERVICE

A. The Contractor shall maintain electrical service to the Existing Buildings during the course of construction. Temporary equipment, switches, cable and whatever else necessary shall be provided as required to maintain electric service. Rules and regulations of local, state and federal authorities respecting safety provisions shall be observed. The Contractor shall use all precautions so as not to endanger the lives of the building occupants or the public. The Contractor shall furnish and install a temporary service should it be required and remove same after need is satisfied. All charges and costs shall be included in the Electrical Contract.

B. When it becomes necessary to temporarily interrupt electric service to any portion of the buildings, the Contractor shall notify the Architect and the Owner in writing at least seven days in advance to enable necessary arrangements to be made. No interruptions will be permitted without the expressed written permission of the Owner.

C. The existing fire alarm system shall be fully maintained in service during the execution of work under this Contract. The Contractor shall furnish and install, and later remove any temporary equipment, wiring or other appurtenances necessary to provide the continuity of service for the system.

1.16 INSTRUCTIONS TO OPERATING PERSONNEL

A. The Contractor shall furnish the services of a person, or persons, approved by the Architect and thoroughly familiar with the completed installation to instruct the Owner's Operating Personnel in the proper operation of the electrical systems and the proper care of all equipment and apparatus included under this Contract. These services shall be furnished for a minimum of two 8-hour days.

- B. During the instruction period, the Contractor and his approved qualified personnel shall demonstrate to the Owner, in the presence of the Architect's representative, the complete operation of the various systems installed under this Contract. Manufacturers' certificates of tests and performance shall be delivered to the Architect and the Owner as hereinafter specified with the various systems or equipment.
- C. When instructions are provided under this Contract, the Contractor shall have in his possession three copies of an identifying letter which shall list the names of the Contractor's qualified instruction personnel including manufacturer's representatives and subcontractors that will be giving the instructions. Likewise on this same letter, spaces shall be provided for the Owner's personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor's representatives and subcontractors shall sign and date the letter, and the Owner's personnel shall also sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One signed copy shall be delivered to the Owner, one copy to the Architect, and one copy shall be retained by the Contractor.
- D. In addition to the verbal instructions outlined above, the Contractor and his manufacturers' representatives and subcontractors shall furnish written basic instructions indicating the proper operation of each system and associated equipment. Each manufacturer shall also submit a brochure on his equipment, including instructions on operation, lubrication, recommended spare parts, and instructions on preventative, routine, and breakdown maintenance.
- E. The Contractor shall combine the written instructions and the manufacturers' equipment brochures in complete volumes with hard back binders which shall be turned over to the Owner before final acceptance of the Contract work. Unless otherwise directed, three (3) copies of the volumes shall be furnished.
- F. All brochures and formats must be approved by the Architect.
- G. It is the intent that this entire system, with its complement of equipment and auxiliary equipment, operate properly in accordance with the design concept and functional intent. It is also the intent that the Owner be given complete instructions for the proper operation and maintenance of the entire system.

1.17 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.18 GUARANTEE/WARRANTY

- A. Written one (1) year full warranty guarantees shall be submitted for the entire electrical installation installed under this project (except for lamps). Where manufacturer's standard guarantee provides for a longer period, the longer period shall apply.

- B. Where defects in the material, equipment and/or workmanship become evident within this guarantee period, the Contractor shall be responsible for replacing such material and equipment with the approved type of new items; and/or correcting the defective workmanship without any costs to the Owner.

1.19 SEQUENCING, SCHEDULING AND COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."
- E. Arrange selective demolition so as not to interfere with Owner's on site operations.
- F. Coordinate electrical equipment installation with other building components.
- G. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.
- H. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning prior to closing in the building.
- I. Coordinate connecting electrical service to components furnished under other Sections.
- J. Notify the Architect at least 5 days prior to commencing demolition operations.
- K. Perform selective demolition in phases – coordinate with mechanical contractor and owner.

PART 2 - PRODUCTS

2.1 CONCRETE BASES

- A. Concrete Forms and Reinforcement Materials: Provide bases for all equipment furnished under this contract.
- B. Concrete: 4000-psi, 28-day compressive strength.

2.2 SLEEVE SEALS

- A. The Contractor shall furnish and install modular wall seals where conduits pass through exterior walls. Seals shall be "Link-Seal" modular wall and casing seal, as manufactured by Thunderline Corporation, or approved equal. Sleeves shall be of appropriate size for the size of conduits to be installed, in accordance with the manufacturer's recommendations. The seal shall be composed of identical solid rubber links, bolted and interlocked to form a belt. As belt bolts are tightened, rubber links form an automatic protective seal. The seal shall be rated for 40 feet of head or 20 psig. Seal shall be capable of absorbing shock transmitted either from changes in internal pipe pressures or from ground disturbances. Seal shall be made of synthetic rubber material especially compounded to resist aging, ozone, sunlight, water, and chemical action, and shall provide low temperature flexibility and resistance to high temperature environments. Bolts and metal parts shall be of carbon steel and zinc phosphate plated to resist corrosion. The seal shall be capable of providing air tightness in above ground installations and hydrostatic sealing in below grade installations. Seal shall be capable of maintaining cathodic protection with Delrin plastic pressure plates. Install seals in accordance with Manufacturer's Bulletin LS-104. Brush underground metal parts with a good grade of mastic before backfill.

2.3 GROUT

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

2.4 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold Formed Steel Tubing: ASTM A 500.
- C. Hot Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Fasteners: Zinc coated, type, grade, and class as required.

2.5 MISCELLANEOUS LUMBER

- A. Framing Materials: Standard Grade, light framing size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP 2, and kiln dried to a moisture content of not more than 19 percent.
- B. Construction Panels: Plywood panels; APA C D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches.

2.6 TOUCHUP PAINT

- A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. For Nonequipment Surfaces: Matching type and color of undamaged, existing adjacent finish.
- C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.7 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacturer's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
 - 1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
 - 2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.
 - 3. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
 - a. One-Part, Nonacid-Curing, Silicone Sealant:
 - 1) "Chem-Calk N-Cure 2000," Bostic Construction Products Div.
 - 2) "Dow Corning 790," Dow Corning Corp.
 - 3) "Silglaze N SCS 2501," General Electric Co.
 - 4) "Silpruf SCS 2000," General Electric Co.
 - b. One-Part, Mildew-Resistant, Silicone Sealant:
 - 1) "Dow Corning 786," Dow Corning Corp.

- 2) "SCS 1702 Sanitary," General Electric Co.
- 3) "863 #345 White," Pecora Corp.
- 4) "Rhodorsil 6B White," Rhone-Poulenc, Inc.
- 5) "Proglaze White," Tremco Corp.
- 6) "OmniPlus," Sonneborn Building Products Div.

D. Acrylic-Emulsion Sealants: One-part, nonsag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

- a. "Chem-Calk 600," Bostik Construction Products Div.
- b. "AC-20," Pecora Corp.
- c. "Sonolac," Sonneborn Building Products Div.
- d. "Tremco Acrylic Latex 834," Tremco, Inc.

E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

- a. "Dow Corning Fire Stop Foam," Dow Corning Corp.
- b. "Pensil 851," General Electric Co.

2.8 REPAIR MATERIALS

A. Use repair materials identical to existing materials. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. This Contractor shall expedite the work for a specific area, section or part of the Project to make provision for, or protect equipment or to permit the installation of another part of the work.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- B. All materials and equipment supplied by this Contractor shall be new, of the best of their respective kinds, without imperfections and blemishes, and shall be protected from the elements prior to installation.
- C. All conduits, wire, cable, wiring devices and equipment shall be installed in such a manner as to preserve access to any existing equipment or to any new equipment installed under this specification or under other specifications or contracts for this Project and with sufficient space provided for proper operation and maintenance.
- D. The drawings are generally indicative of the work to be installed but do not indicate all bends, fittings, boxes, etc., which may be required. The Contractor shall carefully investigate the structural and furnish conditions affecting his work, arrange his work accordingly, and furnish such fittings as may be required to meet such conditions.
- E. This Contractor shall coordinate his work with other trades so that all work may be installed in the most direct manner and so that interference between piping, ducts, equipment, architectural or structural features will be avoided. In cases of interference, conflicts, or fouling results, the Architect shall decide which work is to be relocated, regardless of which was installed first. Such relocation shall be at no additional expense to the Owner.
- F. All materials and equipment installed by the Contractor shall be firmly supported and secured to the building structure/construction as required.
- G. Scaffolding with ladders shall be furnished and erected, where required for the proper installation of wiring, equipment and fixtures.

3.2 ROUGH-IN

- A. Verify final locations for rough ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in other Specification Divisions and approved product data and shop drawings for rough-in requirements.

3.3 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
10. Install access panel or doors where units are concealed behind finished surfaces.
11. Install systems, materials, and equipment giving right of way priority to systems required to be installed at a specified slope.

B. Performance of Equipment

1. All materials, equipment and appurtenances of any kind, shown on the drawings, hereinafter specified or required for the completion of the Project in accordance with the intent of these specifications, shall be completely satisfactory and acceptable in operation, performance, and capacity. No approval either in written or verbal of any drawings, descriptive data, or samples of such material, equipment and/or appurtenances shall relieve this Contractor of his responsibility to turn over the same to the Owner in perfect working order at the completion of the Project.
2. Any material, equipment or appurtenances, the operation, capacity or performance of which does not comply with the drawings and/or specification requirements or which is not new or which is damaged prior to acceptance by the Owner will be held to be defective material and shall be removed and replaced with the proper acceptable materials, equipment and/or appurtenances or put in proper acceptable working order, satisfactory to the Architect with no additional expense to the Owner.
3. All details of the installation of all equipment shall be electrically and mechanically correct. All equipment shall operate without objectional noise or vibration should be produced and transmitted to occupied portions of the building by apparatus, conduit or other parts of a system, any corrections to eliminate noise and vibration shall be at no expense to the Owner.

3.4 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Part 1 paragraph "Related Documents." In addition to the requirements referenced in the "Related Documents" paragraph, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill timed Work.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Install equipment and materials in existing structures.
 - e. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.
2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
 3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
 4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
 6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

B. Cutting, Patching, and Finishing (Existing Building)

1. Electrical Contractor shall be responsible for all cutting, patching, and finishing of existing construction for the proper installation of all electrical equipment and materials to be installed in the existing portion of this project. This will also be required for the removal of the existing equipment and materials. All cutting shall be kept to an absolute minimum consistent with the requirements of the project. Cutting, patching and finishing shall be done by workmen skilled in this type of work. All patching shall be done utilizing materials of the same quality and texture as the adjacent undisturbed areas perfectly and to the satisfaction of the Architect.
 - a. Cutting: Cut and remove existing construction only to the extent required by new Work and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:
 - 1) Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 2) Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3) Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
 - 4) Maintain adequate ventilation when using cutting torches.
 - 5) Cut concrete and masonry at junctures with construction to remain, using power driven masonry saw or hand tools; do not use power driven impact tools.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- b. Patching: Return elements of construction and surfaces to remain to condition existing before start of cutting operations.
- c. Painting
 - 1) Painting of the final finished areas will be by the Prime Contractor. If no Prime Contractor is assigned to this project, the E.C. will provide touch up painting to architectural finishes.
 - 2) Where cutting and patching occurs in areas that the General Contractor does not have any work and/or the General Contractor is not required to finish the wall and/or ceiling that was affected by this Contractor's work, the Electrical Contractor shall paint the affected surface from "natural" break to "natural" break as directed by the Architect. When other trades other than the General Contractor damage the same wall and/or ceiling, the Electrical Contractor shall coordinate his painting responsibilities with the other trades before proceeding with any work in that area.
 - 3) All surfaces to be painted shall receive an undercoat 24 hours before the final coat is applied. Undercoats which show lumps or rough areas shall be smoothed with fine sandpaper or steel wool and dusted off before the final coat is applied. Final coat shall be solid, even color, free of lumps, drops, sags, run brush marks, laps, or other defects, finished to a line where they adjoin other colors or unpainted surfaces.
 - 4) Drop cloths shall be used to protect floors and all other work from damage. Any covering temporarily removed from any part of the work or finish shall be promptly replaced and any damage from neglect to protect all surfaces shall be at the Contractor's expense.
 - 5) Paint color shall match adjoining surfaces as closely as possible and to the satisfaction of the Architect.
- 2. No cutting shall be done which may affect the building structurally or architecturally including building systems without first securing the approval of the Architect. Cutting shall be accomplished in such a manner as not to cause damage to the building or leave unsightly surfaces which cannot be concealed by plates, escutcheons, or other construction. Where unsightly conditions are caused, the Contractor shall be required, at his own expense, to repair the damaged areas.
- 3. Cutting of the construction excessively or carelessly done shall be repaired by this Contractor to match the original work and to the satisfaction of the Architect who will make the final decision with respect to excessive or careless cutting work.
- 4. This Contractor shall seal all openings he has made in plenum spaces, fire rated floors, ceilings or partitions after his work has been installed. The material used for sealing the openings shall have a fire rating equal to or greater than the rating of the floor, ceiling or partition material. Openings shall be suitably treated to prevent passage of stray light, air or sound.
- 5. Where present equipment is removed and unused openings remain in walls, floors, partitions, etc., this Contractor shall properly patch all such openings. All patching and repairing shall be done by workmen skilled by this type or work and shall match present or new finishes.
- 6. All holes or openings for the passage of conduit to be put in existing concrete shall be bored.
- 7. Cutting, patching, and repairing of openings in the existing exterior walls and roof shall be by the General Contractor.

3.5 PROTECTION OF WORK, MATERIALS, AND EQUIPMENT

- A. This Contractor shall effectually protect at his own expense, all existing facilities and such of his new work, materials or equipment as is liable to injury during the construction period. All openings in to any part of the conduit system as well as all associated fixtures, equipment, etc. both before and after being set in place shall be securely covered or otherwise protected to prevent obstruction, damage, or injury due to carelessly or maliciously dropped tools or materials, grit, dirt moisture, water or any foreign matter. This Contractor shall be held responsible for all damage so done, until his work is fully accepted by the Architect. Conduit ends shall be covered with capped bushings.
- B. All surfaces, either finished or in preparation for finishing or finish material application, shall be protected against damage from painting, welding, cutting, burning, soldering or similar construction functions. The protection shall be accomplished by care in operations, covering and shielding. Special care shall be directed to exposed finished masonry, metal or wood surfaces and painted surfaces. Corrective measures required shall be accomplished by the trade which made the original installation and shall be at the expense of the Contractor causing the damage with no cost to the Owner.
- C. Any damage caused by neglect on the part of this Contractor or his representative, or by the elements due to neglect on the part of this Contractor or his representatives, either to the existing work, or to his work or to the work of any other Contractor, shall be repaired at his expense to the Architect's satisfaction.

3.6 CONCRETE BASES

- A. General: Install concrete pads and bases as indicated and as required for all new equipment under this contract.
- B. Forms and Reinforcing Materials
 - 1. Form concrete pads with framing lumber with form release compounds. Chamfer top edge and corners of pad. Anchor or key to floor slab.
 - 2. Install reinforcing bars where required, tied to frame, and place anchor bolts and sleeves to facilitate securing units.
- C. Mounting: Anchor electrical equipment and other system components on concrete housekeeping bases. Provide anchorage according to manufacturer's written instructions, unless otherwise indicated.
 - 1. Concrete Pad: Housekeeping bases shall be 4" high with 1" chamfer edges minimum and shall extend 4" beyond the edge of the electrical equipment on all accessible sides unless indicated otherwise. Coordinate size of equipment with actual unit size before proceeding with any formwork.
 - 2. Clearance: Maintain minimum workspace around components according to manufacturer's Shop Drawings and National Electrical Code.

- D. Concrete: Place concrete and allow to cure before installation of units. Use Portland cement that conforms to ASTM C 150, 4000 psi, 28-day compressive strength, and normal weight aggregate.

3.7 SLEEVE-SEAL INSTALLATION

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

3.8 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements shall be U.L. listed systems.

3.9 CLEAN-UP

- A. Daily, and when directed by the Architect, the Electrical Contractor shall remove all waste and debris resulting from his work.
- B. Upon completion of his work and when directed by the Architect, the Electrical Contractor shall remove all dirt, foreign materials, stains and fingerprints from all equipment, fixtures, panels, plates, etc., installed under this contract. Internal areas of all equipment must be cleaned of all construction dust etc., prior to pre-final and/or final inspection.
 - 1. Clean paint, varnish spots and stains caused by finishing materials used by this Contractor from all walls, floors, trim, glass, hardware, fixtures, masonry or any other surface that is damaged by this Contractor's work.
 - 2. Do not use solvents that would remove or damage the finish of the finish hardware or other factory-finished materials. If damage occurs, the affected materials shall be returned to the factory for refinishing at not expense to the Owner.
 - 3. Repair all finishes damaged by this Contractor in areas that the General Contractor does not have any work and/or the General Contractor is not required to finish the space that was affected by this Contractor's work and leave all work clean and perfect at completion.

END OF SECTION 260500

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports: Indicate and interpret test results for compliance with performance requirements.

1.4 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.

1.5 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- B. Coordinate layout and installation of cables with other installations.
- C. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Houston Wire and Cable
 2. American Insulated Wire Corp.; a Leviton Company.
 3. BICC Brand-Rex Company.
 4. Senator Wire & Cable Company.
 5. Southwire Company.
 6. Carol Cable Co., Inc.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and XHHW.
- D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC and mineral-insulated, Type MI with ground wire.
- E. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- F. Conductor Material: Copper.
- G. Stranding: Conductors No. 10 and smaller, except where herein specified otherwise, shall be solid, and conductors No. 8 and larger shall be stranded.

2.2 METAL-CLAD CABLE

- A. Metal-Clad Cable (Type MC) may be installed in concealed locations for branch circuits of 30 amperes or less. Type MC cable shall be a galvanized sheathed assembly of one or more 600 volt, 90 degree C., copper conductors, each insulated and enclosed in a metallic sheath of interlocking corrugated tubes and shall comply with Article 334 and also applicable provisions of Article 300 of the National Electrical Code. Type MC cable shall be provided with an integral insulated ground conductor and shall be as manufactured by Thomas and Betts, or approved equal.
- B. Type MC cable shall be installed in compliance with the aforementioned Articles and shall be supported and secured at intervals not to exceed six feet. Support wires utilized for suspended ceiling or the suspended ceiling grid system shall not be utilized as the support for this cable. Type MC cable which must be installed exposed to view, in such areas as Mechanical and Electrical Equipment Rooms, shall be installed within rigid steel conduit, intermediate metal conduit, or electrical metallic tubing. Generally, this project has exposed to view work areas.

2.3 CONNECTORS AND SPLICES

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amp Incorporated.
 - 2. O-Z/Gedney; EGS Electrical Group LLC.
 - 3. 3M; Electrical Products Division.
 - 4. Square D Co.; Anderson.
- C. Fittings utilized for the connection of Type MC cable to electrical boxes, cabinets, or other equipment shall be identified for use with Type MC cable and shall be of the type to provide effective bonding between the metallic sheath and such boxes, cabinets, and other equipment and shall be UL and CSA listed. Fittings shall be Thomas and Betts Catalog No. 2-050-008-B, or approved equal. Fittings and supports for Type MC cable shall comply with NEMA FB1 Standard Publication titled "Fittings and Supports for Conduit and Cable Assemblies" and shall be approved by the Engineer prior to installation.
- D. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

2.4 LUGS AND CONNECTORS

- A. The Contractor shall furnish and install all necessary lugs and connectors of proper size and type as required by the work under these specifications. Lugs and connectors shall be installed in strict accordance with the cable and lug manufacturer's recommendations. Lugs and connectors must be suitable, marked and UL listed for the size, type of cable, bus, bolts, etc., connected. All connections shall be hydraulic crimp-type and made tight and solid. Each lug shall have a double lug connection (shall accommodate two bolts) and be crimped on 6 sides.

2.5 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

- A. Underground Feeders and Branch Circuits: Type XHHW 2, in raceway.
- B. Feeders: Type THHN/THWN, in raceway.
- C. Branch Circuits: Type THHN/THWN, in raceway.
- D. Concealed Branch Circuits: Type MC Cable.
- E. Exposed Branch Circuits: Type THHN/THWN, in raceway.
- F. Fire Alarm Circuits: Type THHN/THWN, in raceway.
- G. Class 1 Control Circuits: Type THHN/THWN, in raceway.
- H. Class 2 Control Circuits: Type THHN/THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
- B. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- C. Type MC cable shall be installed in compliance with the aforementioned Articles and shall be supported and secured at intervals not to exceed six feet. Support wires utilized for suspended ceiling, or the suspended ceiling grid system shall not be utilized as the support for this cable. Type MC cable shall not be installed exposed to view, in such areas as Mechanical and Electrical Equipment Rooms. These areas shall have circuits in conduit.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- G. Seal around cables penetrating fire-rated elements.
- H. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- I. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- J. No conductors smaller than No. 12 AWG shall be used. No. 10 AWG conductors shall be installed for all 120 volt circuit runs greater than 100 ft. one way from panel to last outlet. No. 10 AWG conductors shall also be installed for all 277 volt circuit runs greater than 150 feet one way from panelboard to last outlet.
- K. Neutral conductors, shown or not shown, shall be installed for all single phase and for all three phase circuits in which a neutral is required for control circuit voltage.
- L. The conductor ampacities utilized for design purposes are based on 75 degrees C. conductor temperature rating. Where conductors are connected to or run within equipment which are U.L. listed for 60 degrees C., the conductor ampacities shall be based on 60 degrees C. The Contractor shall be responsible for providing the correct size conductors based upon ampacities and temperature ratings of equipment and conductors should any 60 degrees C. equipment be utilized.
- M. Conductors installed in high ambient locations such as electrical resistance heating equipment, in lighting fixture housings or channels, etc., shall be suitable for heat resisting service in accordance with Underwriters' requirements and NFPA 70.
- N. Each bundle or reel of conductors shall bear the maker's name and the Underwriters' label, together with the grade, size, length and manufacturing date. Similar information shall be included on the insulation jacket of the conductors. Secondary conductors shall comply with Federal Specifications JC-30A.
- O. All conductors underground, in or under slabs on grade and to outside outlets shall be continuous from switch to outlet. Conductors no smaller than No. 12 AWG shall be installed for light and power circuits.
- P. Conductors installed directly in Ducts, Plenums, or other spaces used for environmental air shall comply with Article 300.22 of NFPA 70.
- Q. The Contractor shall tag and identify each circuit and phase in all accessible locations such as outlet boxes, junction boxes, pull boxes, panelboards, disconnect switches, starters, equipment, etc. Tags or identification bands shall be nonmetallic, durable type. Paper or cardboard tags are not permitted.
- R. This Contractor shall verify prior to installation that there exists coordination between the overcurrent protective device and the respective circuit conductor sizes shown on the drawings. The Contractor is responsible for identifying discrepancies, between the overcurrent protective device and the respective circuit conductor sizes indicated, and notifying the Architect of such discrepancies prior to purchasing and/or installation of such materials.

- S. The conductor sizes are based on allowable current carrying capacities listed in the National Electrical Code for copper conductors.
- T. Aluminum conductors or copper-clad aluminum conductors will not be permitted.

3.4 CONNECTIONS

- A. Conductor Splices: No splices are permitted. Conductors shall be continuous between terminations.
- B. Use splice and tap connectors compatible with conductor material.
- C. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- F. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 DISTRIBUTION SYSTEM

- A. The electrical distribution system shall be installed, generally, as shown on the drawings. The drawings are diagrammatic and are not intended to show actual conduit locations and routing or exact equipment location. Such items are the responsibility of the Electrical Contractor.
- B. A separate conduit shall be provided for each set of mains, feeders, and branch circuits, except for single pole work on branch circuits where conductors may be grouped in accordance with the National Electrical Code; however, the maximum number of conductors installed in one conduit shall not exceed nine and the use of common neutral conductors is not permitted. More than nine conductors may be installed in one conduit for special systems and locations specifically shown on the drawings or where permitted by the Architect. Grouped conductors shall be derated by the Electrical Contractor in accordance with the requirements of the National Electrical Code Table 310.15(B)(2)(a). Main service conductors or feeder conductors shall not be grouped.
- C. Unless specifically indicated otherwise, all circuitry indicated on the drawings shall be interpreted as 3 #12 awg. conductors within a ¾" conduit. (One #12 awg. phase conductor, One #12 awg. neutral conductor and One #12 awg. ground conductor.) The use of a common neutral conductor in a multiple circuit arrangement is prohibited. Each single-phase circuit shall be provided with a separate neutral conductor. Sharing of a neutral conductor between two or more single phase circuits is not permitted.

3.6 FIRESTOPPING

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

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification, Section 7.3.1. Certify compliance with test parameters. Meggar tests are not required on low voltage conductors and cables.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. The Contractor shall furnish and install all necessary materials and accessories to solidly ground all non-current carrying metal parts of the electrical system.
- C. The Contractor shall measure the resistance of the existing grounding system and supplement the existing to reach the required value specified.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Grounding arrangements and connections for separately derived systems.
 - 2. Grounding for sensitive electronic equipment.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field quality-control test reports. Submit written test reports to include 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. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
 - 1. Instructions for periodic testing and inspection of grounding features at test wells and grounding connections for separately derived systems based on NFPA 70B.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
- b. Include recommended testing intervals.

1.4 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING PRODUCT MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Anixter Brox., Inc
 2. ERICO, Inc.
 3. Ideal Industries, Inc.
 4. O-Z/Gedney Co.
 5. Thomas & Betts Corp.

2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
 1. Comply with Division 26 Section "Conductors and Cables."
- B. Bare copper conductors shall not be used.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.
- D. Braided Bonding Jumpers: Copper tape, braided No. 30 gage bare copper wire, terminated with copper ferrules.
- E. Bonding Strap Conductors/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, unless indicated otherwise.

2.3 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, heavy duty bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
 - 1. Size: 3/4" in diameter x 120" in length.

2.5 APPLICATIONS

- A. Conductors:
 - 1. Comply with Division 26 Section "Conductors and Cables."
- B. Underground Grounding Conductors: Install bare tinned copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 30 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

2.6 EQUIPMENT GROUNDING

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install a separate insulated equipment grounding conductors with all feeders and circuits. The use of the metallic raceway or cable sheath as the equipment grounding conductor is prohibited.
- C. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- D. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- F. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- H. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- I. Metal and Wood Poles Supporting Outdoor Lighting Fixtures: Install a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors and bond all metal parts on the pole, pole base, and fixture.

2.7 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- C. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install braided type bonding jumpers to bond across flexible duct connections to achieve continuity.
- E. Grounding for Steel Building Structure: Install a driven ground rod at base of each new corner column and at new intermediate exterior columns at distances not more than 60 feet apart.

2.8 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

- C. Equipment Grounding Conductor Terminations: Use pressure-type grounding lugs. All lugs used in the building system shall be rated copper only, copper-aluminum rated lugs shall not be acceptable.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

2.9 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.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified.
 - a. Perform tests by fall-of-potential method according to IEEE 81.
- C. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 5 ohms.
 - 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohms.
- D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

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

1.5 SUBMITTALS

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

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

- a. Allied Tube & Conduit.
- b. Cooper B-Line, Inc.; a division of Cooper Industries.
- c. ERICO International Corporation.
- d. Thomas & Betts Corporation.
- e. Unistrut; Tyco International, Ltd.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron casting with hot-dip galvanized finish.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Powder-Actuated Fasteners should not be used in lightweight concrete or slabs less than 4 inches thick.
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) Fastenal Company
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Hilti Inc.
 - 3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 4) Fastenal Company
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Zinc plated low carbon threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 HANGERS AND PLATES

- A. All horizontal conduit or equipment within the building that is hung shall be hung from building construction with beam clamps or inserts in concrete, galvanized threaded extension rods, and approved hangers. Hangers and supports shall be arranged to distribute the weight of conduit and equipment uniformly on the structure. All conduits shall be securely fastened in place by means of galvanized malleable or galvanized stamped steel clamps, hanger rings, inserts or other approved galvanized supports.
- B. Spring steel clips may be used for supporting conduit. The spring steel clips, the arrangement of the spring steel clips and the method of fastening is subject to review by the Architect prior to installation.

- C. All necessary structural supports and inserts to hang all conduit and other miscellaneous equipment shall be provided by this Contractor. Steel plates and other supports shall be installed in the concrete construction. Hanger rods shall be securely attached to plates. Where cutting is required for the installation of hangers, conduit and supports, all openings must be neatly drilled by the Electrical Contractor. Punching or chipping of concrete will not be permitted. All necessary openings shall be drilled in a location and manner satisfactory to the Architect. All concrete damaged by the Electrical Contractor shall be patched, reinforced, or replaced as directed by the Architect. Location of all holes and openings shall clear reinforcing steel in floor and roof decks. The Electrical Contractor shall coordinate all work with the General Contractor and shall determine exact locations of all supports and openings.
- D. Furnish and install all required concrete inserts. Multiple inserts shall not be installed in a concrete structural slab less than 4" thick. For concrete structural slabs less than 4" thick, the Contractor shall furnish and install structural beams, angles, etc., built into general construction, as required. Multiple inserts may be installed only where approved by the Architect.
- E. The Contractor shall place all hanger and support inserts in concrete. Fish plates shall be installed where hangers are attached through steel decking.
- F. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- G. Use pipe straps or individual conduit hangers for supporting individual conduits.
- H. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 pounds. Secure each conduit with U-bolts or other approved fasteners.
- I. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- J. Independently support conduit. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, mechanical piping, or mechanical ducts).
- K. Fasteners and Supports in Solid Masonry and Concrete:
 - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
- L. Hollow Masonry: Toggle bolts are permitted. Bolts supported only by plaster are not acceptable.
- M. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- N. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- O. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

- P. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.3 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

3.4 INSTALLATION OF FABRICATED METAL SUPPORTS

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

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

- 1. Raceways include the following:

- a. RMC.
 - b. RNC.
 - c. EMT.
 - d. Wireways.
 - e. Surface Metal Raceway (SMR).

- 2. Boxes, enclosures, and cabinets include the following:

- a. Device boxes.
 - b. Outlet boxes.
 - c. Pull and junction boxes.
 - d. Cabinets and hinged-cover enclosures.

- B. Related Sections include the following:

- 1. Division 26 Section "Common Work Results for Electrical" for raceways and box supports.
 - 2. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. LFNC: Liquidtight flexible nonmetallic conduit.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- F. RMC: Rigid metallic conduit.
- G. RNC: Rigid nonmetallic conduit.
- H. SMR: Surface Metal Raceway.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1.5 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Metal Conduit and Tubing
 - a. Allied Tube & Conduit; a Tyco International Ltd. Co
 - b. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - c. Anixter Brothers, Inc.
 - d. Triangle PWC, Inc.
 - e. Wheatland Tube Company.
 - f. Wiremold Legrand Company.
 - 2. Conduit Fittings:
 - a. Crouse-Hinds; Div. of Cooper Industries.
 - b. Emerson Electric Co.; Appleton Electric Co.
 - c. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. O-Z/Gedney; Unit of General Signal.
- B. Rigid Steel Conduit: ANSI C80.1.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

1. Rigid steel conduit shall be zinc coated, or galvanized or sherardized on all surfaces. An additional bituminous coating shall be applied over the zinc where installed in wet locations. Conduit fittings shall be made from the same grade of steel as rigid steel zinc coated conduit and shall be treated, protected, threaded, etc., in every way according to the requirements for rigid steel zinc coated, conduit, insofar as they apply.
- C. Aluminum Rigid Conduit: ANSI C80.5.
- D. IMC: ANSI C80.6.
1. Galvanized intermediate metal conduit may be used for the installation of conductors where permitted by the National Electrical Code. Intermediate metal conduit shall be assembled with threaded couplings and connectors similar to that specified for rigid conduit. Conduit shall conform to Article 345 of the National Electrical Code. Conduit shall be hot-dipped galvanized steel manufactured in accordance with UL Standard No. 6, or UL Standard No. 1242.
- E. EMT: ANSI C80.3.
1. Electrical metallic tubing shall be zinc coated, galvanized or sherardized on all surfaces. Tubing shall bear the Underwriters' and manufacturer's label and shall conform to Federal Specifications WW-C-563. Maximum size of electrical metallic tubing permitted is 4" size. Electrical metallic tubing shall not be installed in wet locations.
- F. FMC: Zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket.
- H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed
1. Compression fittings shall be used for EMT up to two (2) inches. On EMT conduits larger than two (2) inches, compression fittings or steel-sleeve set screw fittings shall be used.
 2. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
- I. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.
- 2.2 NONMETALLIC CONDUIT AND TUBING
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Certainteed Corp.; Pipe & Plastics Group.
 2. George-Ingraham Corp.
 3. Lamson & Sessions; Carlon Electrical Products.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

4. R&G Sloan Manufacturing Co., Inc.
 5. Thomas & Betts Corp.
- B. ENT: Not Permitted.
- C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- D. LFNC: UL 1660.
- E. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- F. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

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

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Wiremold Company (The); Electrical Sales Division, Designer Series, or approved equal.
 2. All surface mounted raceway shall meet requirements for CAT 6A shielded data cabling.

2.5 BOXES, ENCLOSURES, AND CABINETS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. Hoffman Engineering Co.; Federal-Hoffman, Inc..
 - 3. O-Z/Gedney; a unit of General Signal.
 - 4. RACO; a Hubbell Company.
 - 5. Thomas & Betts Corporation.
- C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.
- E. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.
- F. Nonmetallic Floor Boxes: Nonadjustable, round.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- I. Provide and install steel outlet box. Boxes shall be of approved design and construction and in every instance be of such form and dimensions as to be best adapted to its specific location, kind of fixtures to be used, and the number, size, and arrangements of conduits connecting thereto. The boxes and covers shall be made of pressed steel galvanized, of not less than 1/16" thickness. Boxes in Mechanical and Electrical Equipment Rooms and all other locations shall be installed flush with wall or ceiling construction where possible.
- J. Cast aluminum device boxes with rounded edges and corners, complete with matching coverplates, shall be used in connection with exposed conduit work for switches and receptacles in all unfinished locations including pipe spaces. Boxes shall be of the Cast Hub type as manufactured by Crouse-Hinds, Appleton or Thomas and Betts. Exposed boxes and conduit may be used only when specifically approved at each location designated. All exposed box locations must be approved by the Architect prior to installation.
- K. Boxes at exterior of building shall be flush mounted, cast iron, water tight, with gaskets and bolted-on covers. Boxes for all exterior fixtures, exterior receptacles, etc., mounted in exterior walls of the building or flush mounted at other exterior locations shall be cast iron or cast aluminum gasketed and made weathertight.
- L. Where the space limitations or other local conditions influence the arrangement and details of the outlet, special forms and design of outlet boxes shall be used to secure a proper, complete, and workmanlike arrangement at the outlet.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- M. Diamond expansion, cinch, or Rawl plug anchors shall be used in all cases for securing boxes to masonry walls or partitions.
- N. All outlet boxes shall be provided with covers and they shall be of such construction and design as to exactly fit and match the box in which they are installed. Covers in exposed locations shall be stainless steel unless specified otherwise herein.
- O. Ceiling and wall outlet boxes generally shall be 4" square or octagon with plaster rings and shall have two screw holes for mounting receptacles when same are specified. Gang boxes and adjustable covers shall be used where wall switches occur in gangs. Metal partitions shall be provided in all gang boxes where dissimilar services are installed. Thermal switches furnished by other contractors, to the Electrical Contractor for installation, will have separate wall plates and may be mounted separately but adjacent to wall switches. Boxes for communications systems shall be of type recognized and recommended by EIA/ TIA/ BICSI and shall be sized as required to conform with the conduits connecting thereto. All boxes for switches, receptacles, special outlets, etc. shall be provided with stainless steel coverplates as herein specified.
- P. Boxes installed in concrete block or other masonry walls without a plaster finish shall be of the square corner type, single or multiple gang, made specifically for that purpose.
- Q. Boxes on prewired fixtures shall not be used for through-circuit wiring, except where the fixtures are specifically UL approved for that purpose.
- R. Multiple-gang boxes shall not be used for 277 volt switches, unless the switches are connected to the same phase. Separate boxes or barriers shall be installed for multiple switches where phase-to-phase exceeds 277 volts between switches.
- S. Provide a minimum of 1'-0" of physical separation between outlet boxes on opposing sides of the same wall. Boxes shall not be mounted back to back or within 1'-0" of any outlet box on the opposing sides of the same wall.
- T. Furnish and install metal pull boxes at least every 100 feet of run and as may be required to facilitate the pulling of wires. Pull boxes shall be of not less than No. 12 gauge galvanized steel metal of such design, construction and dimensions as to be best adapted to their respective location, number, size, and arrangement of conduit connecting thereto, and shall be provided with suitable doors, securely fastened to box with machine screws. Holes shall be provided in all boxes to receive entering conduits, but there shall be no holes except those used by conduits. Pull boxes installed flush with ceilings shall be provided with hinged doors, adjustable trim and screwdriver latch.
- U. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- V. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid aluminum conduit
2. Concealed Conduit, Aboveground: Rigid aluminum conduit.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or 4.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed: EMT or RMC.
2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT or RMC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: Rigid steel conduit.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings.
2. EMT Conduit: Use Steel Compression fittings

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Minimum Raceway Size: 3/4 inch trade size.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- C. 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.
- D. Complete raceway installation before starting conductor installation.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- G. Protect stub-ups from damage where conduits rise through floor slabs. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- J. Use steel raceway fittings compatible with raceways and suitable for use and location. For rigid steel conduit, use threaded rigid steel conduit fittings.
- K. Raceways Embedded in Slabs: Do not install raceways in floor slabs with a slab thickness of less than 4". Install in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Transition from nonmetallic conduit to rigid steel conduit, or IMC before rising above floor.
- L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- N. 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.
- O. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- P. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- Q. Telephone, data and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- R. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations.
 2. Where otherwise required by NFPA 70.
 3. Where conduit sleeves penetrate smoke and/or fire walls.
- S. 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 the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
- T. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semirecessed lighting fixtures. Use maximum of 3 feet of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- U. Fiberglass Conduit Elbows: Use in conjunction with RNC conduit. Patch all nicks and scrapes after installing conduits. Elbows shall have a wall thickness that provides a compressive strength that exceeds that of Schedule 40 PVC conduit.
- V. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
1. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
 2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- X. Set floor boxes level and flush with finished floor surface.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- Y. All conduits shall be installed in a neat, craftsman-like manner and be concealed in all finished areas. Conduit shall be installed parallel or perpendicular to walls, ceilings and other building components to present a neat appearance.
- Z. Under no circumstances will horizontal runs of conduit or tubing be permitted within walls or partitions.
- AA. The installation of all types of conduit and tubing shall comply with the following:
 - 1. Where conduits are fastened to masonry the use of screws is permitted only with expansion sleeves or Rawl plugs.
 - 2. The exact routes and location of conduit shall be determined at the site by the Contractor as the drawings are diagrammatic only and not intended to convey that information.
 - 3. Conduit that is cut shall be sawed and properly reamed.
 - 4. The ends of all conduit shall be capped or plugged to exclude dirt and debris and prevent condensation.
 - 5. Conduit that is damaged or deformed shall not be installed.
 - 6. Bending of conduits and tubing will be permitted in small sizes (less than 2" in diameter). Standard ells and fittings shall be used for larger sizes (greater than 2" in diameter) of conduit or tubing. Bends, where approved, shall be made with an approved hickey or conduit bending machine.
 - 7. Conduits and wiring shall be located to prevent their contact with heated surfaces and the conduit and wiring shall be suitably insulated, where required, to resist excessive heat. All work must be done in a manner that will not interfere with or detract from the fireproofing and smokeproofing of the building structure. Openings around conduits and penetrations through fire-rated floors, walls, partitions and ceilings shall be sealed with high temperature fire-resistant and fireproof materials and sealed with metal fire stops. O.Z./Gedney "Fire Seal" fittings, or equivalent, shall be used.
 - 8. Sleeves shall be installed in concrete and masonry. Sleeves shall be large enough to receive the conduit.
 - 9. Where vertical conduits pass through floors in mechanical or electrical equipment areas, chases or pipe spaces, the Contractor shall construct watertight sleeves made up of a section of Schedule 40 steel pipe extending 2" above the floor.
 - 10. Where vertical conduits pass through floors in finished spaces, the Contractor shall construct watertight sleeves made up of a section of steel pipe of proper length to extend through masonry and terminate flush on finish side.
 - 11. Where horizontal conduits pass through walls, sleeves shall be as specified above terminating flush with finish on each side.
 - 12. Where vertical conduits pass through plaster ceilings, sleeves shall be No. 18 gauge galvanized steel flush with ceiling.
 - 13. Space between sleeve and conduit shall be filled with sealant to level of sleeve. Sealant shall be approved "Fire Stopping" and shall maintain the fire rating of the wall or floor in which it passes through. "Fire Stopping" shall conform with manufacturer's recommended installation procedures.
 - 14. Seal openings through walls of air plenum spaces and relief air shafts, where conduits are installed under this Contract to assure airtight plenum spaces. Coordinate work with contractors of other trades.
 - 15. Where conduits pass through fire and smoke barrier stops, ceilings, floors or walls, this Contractor shall thoroughly seal such openings with fire-rated sealant as required to maintain fire-rating of adjacent construction.

16. The Contractor shall furnish and install modular wall seals where conduits pass through exterior walls. Seals shall be "Link-Seal" modular wall and casing seal, as manufactured by Thunderline Corporation, or approved equal. Sleeves shall be of appropriate size for the size of conduits to be installed, in accordance with the manufacturer's recommendations. The seal shall be composed of identical solid rubber links, bolted and interlocked to form a belt. As belt bolts are tightened, rubber links form an automatic protective seal. The seal shall be rated for 40 feet of head or 20 psig. Seal shall be capable of absorbing shock transmitted either from changes in internal pipe pressures or from ground disturbances. Seal shall be made of synthetic rubber material especially compounded to resist aging, ozone, sunlight, water, and chemical action, and shall provide low temperature flexibility and resistance to high temperature environments. Bolts and metal parts shall be of carbon steel and zinc phosphate plated to resist corrosion. The seal shall be capable of providing air tightness in above ground installations and hydrostatic sealing in below grade installations. Seal shall be capable of maintaining cathodic protection with Delrin plastic pressure plates. Install seals in accordance with Manufacturer's Bulletin LS-104. Brush underground metal parts with a good grade of mastic before backfill.

3.3 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.4 PROTECTION

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

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage.
- C. Colors for Raceways Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high letters on 20-inch centers.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or more: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

- A. Conductors rated at 600V or Less:
 - 1. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Conductors rated at more than 600V:
 - 1. Identified by a durable nonmetallic engraved tag at every point of access at both ingress and egress points of manholes. Tags shall be white with black lettering.

2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70, NFPA 70E 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. Baked-Enamel Warning Signs for interior use:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs for exterior use:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 10 by 14 inches.
- E. Provide arc flash hazard labels with the following information:
 - 1. Flash Protection Boundary.
 - 2. Incident Energy at 18" expressed in cal/cm^2 .
 - 3. Hazard Risk Category.
 - 4. PPE Required.
 - 5. Voltage Shock Hazard.
 - 6. Limited shock approach boundary.
 - 7. Restricted shock approach boundary.
 - 8. Prohibited shock approach boundary.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/8 inch thick.
 - 1. Engraved legend with black letters on white face
 - 2. Punched or drilled for mechanical fasteners.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

- C. Receptacle and switch cover plates shall have self adhesive labels that indicate panel and circuit number and durable wire markers or tags shall be used inside the outlet boxes.

PART 3 - EXECUTION

3.1 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 signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding 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 or use solid colored conduit as manufactured by Allied Tube and Conduit or equal.
 - 1. Apply the following colors to the systems listed below:
 - a. Fire Alarm System: Red.
 - b. Data/Communication: Blue.

3.2 IDENTIFICATION SCHEDULE

- A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inchwide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
 - 1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to raceways concealed within wall.
 - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Control.
 - 2. Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 4 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral: White.
 - 5) Ground: Green.
 - 6) Isolated Ground: Green with yellow stripe.
 - 2. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Date of installation; e.g. INSTALLED JULY 2027.
- E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- F. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two 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.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Enclosed switches.
 - e. Enclosed circuit breakers.
 - f. Enclosed controllers.
 - g. Push-button stations.
 - h. Power transfer equipment.
 - i. Contactors.
 - j. Remote-controlled switches, dimmer modules, and control devices.
 - k. Battery-inverter units.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- l. Monitoring and control equipment.
- m. Receptacles.
- n. Lighting Switches.

END OF SECTION 260553

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

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

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

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 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 that allows adjustments.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

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

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

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

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. Siemens Energy & Automation, Inc.
 3. Square D; Schneider Electric
 4. General Electric Company ABB
- B. Enclosures: Flush- and surface-mounted cabinets.
1. Rated for environmental conditions at installed location.
 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 5. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 6. Directory Card: Inside panelboard door, mounted in transparent card holder. At the end of the project all directory cards shall be up to date and typed to reflect panel loads.
 7. All panelboards shall have a common keyed lock.
- C. Incoming Mains Location: Top and bottom.
- D. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Each section of multiple compartment panelboard shall be provided with full size buses, or each section shall be protected by an individual circuit breaker where panelboard bus sizes are reduced. Separate section circuit breakers are not necessarily shown in the panelboard schedules and are the responsibility of the panelboard manufacturer and the electrical contractor.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

- E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Compression type.
 - a. Main and neutral lugs shall be oversized when ordered if the specified feeder conductors are oversized due to voltage drop or other design considerations.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical or compression type.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- H. Circuit Breakers requiring a sub-chassis within the panelboard to be mounted shall not be permitted. Provide all circuit breakers within the panelboard that do not require panelboard chassis modifications. All circuit breakers within the panelboard shall mount to a single standard bolt-on panelboard chassis.

2.2 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Door-in-door construction with hinged front panels and hinged doors; secured with flush latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- C. Mains: Refer to panel schedules.
- D. Branch Overcurrent Protective Devices for all Circuit-Breaker Frame Sizes: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Refer to panel schedules.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Door-in-door construction with hinged front panels and hinged doors; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits; Type HACR for feeding heating, air conditioning and refrigeration loads.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - f. The circuit breakers shall be 1-pole, 2-pole, or 3-pole, with trip elements calibrated in capacities as shown on the drawings. Circuit breakers shall be suitable for operation at the indicated voltage. Circuit breakers shall be "ambient compensated for enclosures" and shall be capable of carrying their full nameplate rating in a surrounding temperature of 40 degrees C. All circuit breakers shall be of the "bolt-on" type. Bolt-on shall be defined as a direct electrical connection bolted to the panelboard bus bars. The use of a mechanical bolted connection or bolting the circuit breakers to a module which utilizes a spring loaded latching type connection will not be permitted. All circuit breakers shall be of the same manufacturer.
 - g. Main circuit breakers shall be unit type with permanent, non-interchangeable, trip elements.
 - h. Branch circuit breakers of 150 ampere frame capacity or less shall be unit type with permanent trip elements. Branch circuit breakers of over 150 ampere capacity shall have removable trip elements for ready interchangeability. In lieu of interchangeable trip elements, the Contractor may provide electronic trip type circuit breakers, as approved by the Architect. Circuit breakers having an ampacity rating of 250 amperes up to 400 amperes shall have an instantaneous trip adjustable from 3x to 10x of the full load current rating. Circuit breakers having an ampacity rating of 400 amperes and greater shall be electronic trip type.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- i. Automatic tripping of all breakers shall be secured by means of a bimetallic thermal element of each pole engaging a common trip, supplemented by an instantaneous trip on current values ten times normal and above. The trip elements shall insure constant calibration and be capable of withstanding excessive short circuit conditions without injury. Tie handles will not be permitted for multiple pole breakers, except the breakers are of the common trip type.
- j. The individual tripping elements shall be enclosed and sealed in units of molded composition to eliminate tampering or unauthorized changes in calibration. The ampere rating of each circuit breaker shall be clearly and permanently designated on its operating handle.
- k. The circuit breakers shall have inverse-time-element characteristics so that tripping will be prevented on momentary overloads, but will occur before dangerous values are reached.
- l. The breakers shall be operable in any position and removable from the front of the panelboard without disturbing adjacent units.
- m. Each branch circuit shall be distinctly numbered.
- n. The mechanism shall trip free from the handle so that contacts cannot be held closed against short circuit or abnormal overloads.
- o. Breakers shall have a quick-make and quick-break toggle mechanism insuring full contact pressure to the time of opening, whether actuated automatically or manually. Contacts shall be nonwelding silver alloy type. The principle of arc dividing and cooling shall be incorporated in the breakers.
- p. Automatic tripping shall be clearly indicated by trip indicators and the handle automatically assuming a position between the manual "ON" and "OFF" position. Each individual circuit breaker shall have a single operating handle and shall be of the single circuit type.
- q. Circuit breakers shall have NEMA and UL listed symmetrical interrupting ratings of not less than the interrupting rating indicated on the circuit breaker schedules. All circuit breakers shall have the interrupting ratings indicated. The use of series rated circuit breakers to obtain the required interrupting ratings will not be permitted. Circuit breakers shall comply with, but not be limited to, Underwriters' Laboratories Standard No. 489 and the National Electrical Manufacturers Association Standard Publication No. AB-1.
- r. Circuit breakers for exhaust fans, power roof ventilators, and all circuit breakers in "Emergency" and "Normal/Emergency" panelboards shall be provided with set screw type locking devices. Circuit breakers shall be normally locked in the "On" position but shall be capable of tripping on overloads. Circuit breakers in emergency panels and breakers for area protection shall be furnished with locking devices as herein specified.
- s. Circuit breakers for circuits with exterior receptacles, and at other locations indicated on the drawings shall be of the ground fault interruption type. Ground fault interrupter circuit breakers shall be of ratings shown, minimum of 10,000 RMS symmetrical amperes, trip indicating handle for immediate identification of faulty circuits, push-to-test button, solid state ground fault sensing and signaling circuitry, overload and short circuit protection, and arranged to provide 5 milliamp maximum ground fault protection and tripping.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Mount top of trim 78 inches above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- H. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- C. Conductors shall be attached to all wiring device ground terminals with approved crimp-on, insulated fork terminal connectors.

3.5 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. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, 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. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
 - 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.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated in the selective coordination study.

3.7 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 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Cord and plug sets.
 - 3. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.

1.4 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.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

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

- B. Comply with NFPA 70.
- C. All wiring devices shall be provided by a single source.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 RECEPTACLES - GENERAL

- A. All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
- B. Mounting straps shall be nickel plated brass, brass, nickel plated steel or galvanize steel with break-off plaster ears, and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
- C. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.
- D. Receptacles with factory mounted pigtails are not permitted.

2.3 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, light industrial specification grade 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498 and FS W-C-596.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; AH5361 (single), AH5362 (duplex).
 - b. Hubbell; HBL5361 (single), 5362 (duplex).
 - c. Leviton; 5891 (single), 5362 (duplex).
 - d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A. Where required by the National Electrical Code Receptacle shall be stamped with a 'WR' on the face of the receptacle:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; VGF20A.
 - b. Hubbell; GF20LA.
 - c. Leviton; 7899.
 - d. Pass & Seymour; 2095HG.

2.5 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: nylon

2.6 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Existing Conductors shall not be reused. Remove existing and re-pull new in existing conduits.

D. Device Installation:

1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
3. Stranded wire shall be terminated to all wiring devices with approved fork terminals on side mounted terminating screws.
4. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
5. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
6. Tighten unused terminal screws on the device.
7. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up.

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

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top.

H. Any outlet installed by the Contractor in such a location as to be out of proper relation to beams, walls, or other details of the building, shall be corrected by and at the expense of the Contractor.

I. Unless otherwise indicated, outlet boxes in walls shall be located with centerline at the following elevations above finished floor:

1. Convenience Outlets 1'-6", or 6" above back splash of countertops.
2. Miscellaneous Equipment Outlets Manufacturer's Recommendations.

J. Where outlets are designated with centerline at 8'-0" and ceiling heights are 8'-6" or lower, outlets shall be located with centerline 1'-0" below ceiling. Thermostat and other outlet locations shall vary from above heights where applicable State or Local Codes differ from the above.

- K. These heights may be changed to meet building conditions, in which case the Contractor shall use new dimensions given him by the Architect. All fire alarm stations and sounding devices shall be installed on same vertical centerline. Outlets shall be located in a symmetrical manner. The Electrical Contractor shall cooperate with the General Contractor in locating ceiling fixtures in rooms and other locations where acoustical tile ceilings are installed. Fixtures shall be located symmetrically on centers of tile blocks where possible.

3.2 GFCI RECEPTACLES

- A. GFCI receptacles shall not be installed to "feed-through" for protection of downstream receptacles. A GFCI receptacle shall be installed at each location that a GFCI receptacle is shown/required.

3.3 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 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.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 5 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
 - 1. Feeder and branch-circuit protection.
 - 2. Motor and equipment disconnecting means.

1.3 SUBMITTALS

- A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each switch and circuit breaker.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. 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. Current and voltage ratings.
 - c. Short-circuit current rating.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Field Test Reports: Submit written test reports and include 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.
- D. Manufacturer's field service report.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- E. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
 - 1. Routine maintenance requirements for components.
 - 2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
 - 3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.4 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 NEMA AB 1 and NEMA KS 1.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.5 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fusible Switches and Molded-Case Circuit Breakers:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. Square D Co.
 - c. Siemens.

2.2 ENCLOSED SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.

CCAC Allegheny Campus - KLI Building
Lab Refrigerator Power
Pittsburgh, PA

- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with Class "R" or "L" clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

2.3 ENCLOSED CIRCUIT BREAKERS

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Comply with molded-case circuit breaker specifications in the Division 26 section, "Panelboards."

2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard color paint applied to factory-assembled and -tested enclosures before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with mounting and anchoring requirements specified in Division 26 "Common Work Results for Electrical."

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Common Work Results for Electrical."

- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.4 CONNECTIONS

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.
- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
 - 2. Test continuity of each line- and load-side circuit.
- B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated 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.

3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated on the selective coordination study to be provided by this Contractor.

3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. 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.

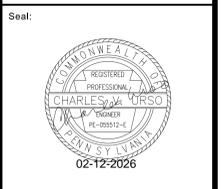
END OF SECTION 262816



COMMUNITY COLLEGE OF ALLEGHENY COUNTY KLI SCIENCE CENTER

Consultants:

Consultants:



Seal:

Project Identification:
**COMMUNITY COLLEGE OF ALLEGHENY COUNTY
ALLEGHENY CAMPUS
K. LEROY IRVIS SCIENCE CENTER**

LAB REFRIGERATOR POWER

**808 RIDGE AVE.
PITTSBURGH, PA
15212**

No.:	Date:	Description:

Sheet Title:
COVER SHEET

Project No.: 2025-1929.01

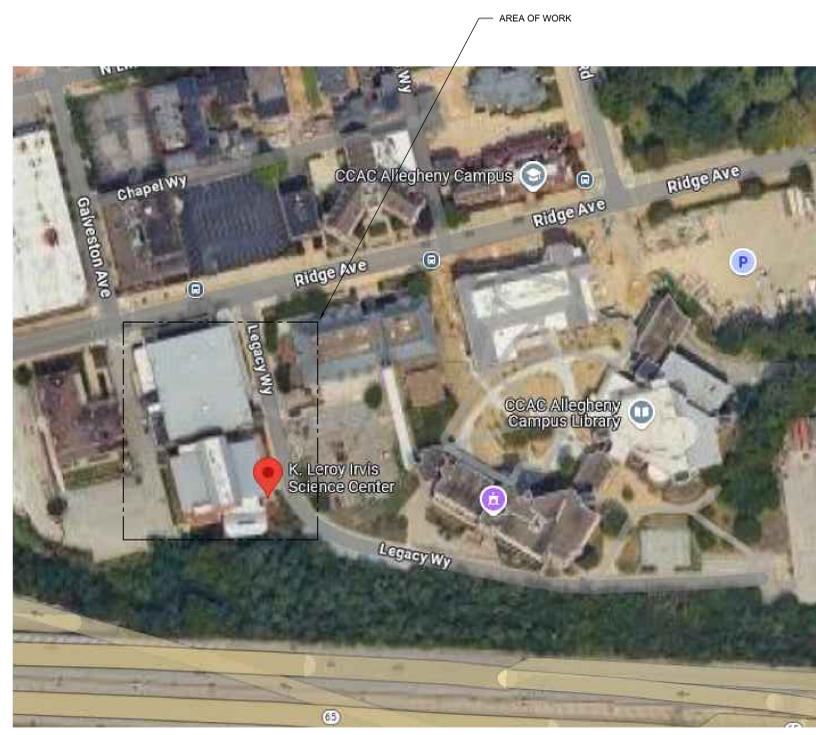
Cadd Drawing File: 1255-SC-XP-CS000.dwg

Drawn By: AJP/NAW

Checked By: CVU

Date: 02/12/2026

Drawing Number
C000
Sheet 01 of 09



SHEET NUMBER	SHEET NAME	PERMIT SET - 02.12.2026
C000	COVER SHEET	
E001	SYMBOLS, NOTES, AND ABBREVIATIONS	
E101	FIRST FLOOR PLAN	
E102	SECOND FLOOR PLAN	
E103	THIRD FLOOR PLAN	
E104	FOURTH FLOOR PLAN	
E501	DETAILS	
E601	PANEL SCHEDULES	
E701	EXISTING RISER	
E702	NEW WORK RISER	

SYMBOL & ABBREVIATION SCHEDULE

NOTES:

- THIS SCHEDULE IS A STANDARD SCHEDULE. CERTAIN SYMBOLS & ABBREVIATIONS INDICATED ON THIS SCHEDULE MAY NOT APPEAR ON THE DRAWINGS.
- DEMOLITION DRAWINGS - EQUIPMENT SYMBOLS SHOWN WITH DASHED LINES ON THE DRAWINGS INDICATE EXISTING EQUIPMENT TO BE REMOVED.
- CERTAIN MOUNTING HEIGHTS INDICATED ON THIS DRAWING ARE TO BE USED AS A GUIDE ONLY AND MAY HAVE TO BE CHANGED TO COMPLY WITH REGULATIONS GOVERNING MOUNTING HEIGHTS OF EQUIPMENT FOR USE BY THE PHYSICALLY HANDICAPPED. CONSULT WITH THE AUTHORITY HAVING JURISDICTION BEFORE EQUIPMENT INSTALLATION AND INSTALL ACCORDINGLY.

RECEPTACLES LEGEND

⊙	SINGLE RECEPTACLE
⊙C	CLOCK HANGER OUTLET
⊙	DUPLEX RECEPTACLE
⊙ 2	DOUBLE DUPLEX RECEPTACLE
⊙AB	DUPLEX RECEPTACLE - ABOVE COUNTER
⊙AB GFI	DUPLEX GROUND FAULT INTERRUPTER RECEPTACLE ABOVE COUNTER
⊙B	DUPLEX RECEPTACLE - MOUNTED IN BASE OF EQUIPMENT
⊙C	COMPUTER RECEPTACLE
⊙D	DUPLEX RECEPTACLE ON DROP CORD
⊙GFI	DUPLEX GROUND FAULT INTERRUPTER TYPE RECEPTACLE
⊙G	DUPLEX ISOLATED GROUND TYPE RECEPTACLE
⊙L	DUPLEX RECEPTACLE - MOUNTED FLUSH IN LABORATORY EQUIPMENT
⊙T	TWISTLOCK DUPLEX RECEPTACLE
⊙R	DUPLEX, TAMPER RESISTANT, GROUNDING TYPE RECEPTACLE
⊙TV	TELEVISION POWER OUTLET - 12" BELOW CEILING UNO
⊙WC	WATER COOLER - DUPLEX RECEPTACLE
⊙WP	DUPLEX WEATHERPROOF RECEPTACLE
⊙F	DUPLEX RECEPTACLE - MOUNTED FLUSH IN FLOOR (SEE DETAIL)
⊙P	DUPLEX RECEPTACLE - POKE-THRU (SEE DETAIL)
⊙	DUPLEX TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) TYPE RECEPTACLE
⊙	DUPLEX RECEPTACLE CONNECTED TO EMERGENCY POWER SYSTEM
⊙	3-WIRE RECEPTACLE - RATING AS NOTED ON DRAWINGS
⊙	POWER POLE WITH RECEPTACLE
⊙	QUADRAPLEX RECEPTACLE
⊙	RECEPTACLE - QUADRAPLEX MOUNTED FLUSH IN FLOOR
⊙	SPECIAL PURPOSE RECEPTACLE
⊙	COMBINATION DUPLEX RECEPTACLE/INFORMATION OUTLET FLUSH MOUNTED IN FLOOR
⊙REF	REFRIGERATOR - DUPLEX GROUND FAULT INTERRUPTER TYPE RECEPTACLE CONNECTED TO EMERGENCY POWER SYSTEM
⊙REF	REFRIGERATOR - DUPLEX GROUND FAULT INTERRUPTER TYPE RECEPTACLE

MISCELLANEOUS ELECTRICAL LEGEND

□	ELECTRICAL PANEL BOARD - SURFACE MOUNTED
□	ELECTRICAL PANEL BOARD - RECESSED
①	INDICATES NOTES ELSEWHERE
∅	PHASE
---	SWITCH LEG
---	BRANCH CIRCUIT
---	SWITCHED CIRCUIT
---	HOMERUN TO PANEL BOARD - 3 #12-3/4" UNO
////	CROSS HATCHING INDICATES EQUIPMENT AND/OR WIRING TO BE RENDERED DEAD AND REMOVED BY EC.
DC	DROP CEILING
EX	EXPOSED/HARD CEILING
ARA RS	AREA OF RESCUE ASSISTANCE - REMOTE STATION
ARA	AREA OF RESCUE ASSISTANCE SIGN ON LIFE SAFETY POWER

ABBREVIATIONS

A	AMPERE	KVAR	KILOVAR
AB	ABOVE COUNTER	KW	KILOWATT
ABBREV	ABBREVIATIONS	KWH	KILOWATT HOURS
ADA	AMERICANS W/IDISABILITIES ACT	LAN	LOCAL AREA NETWORK
AF	AMP FRAME, AMP FUSE	MATV	MASTER ANTENNA TELEVISION
AFB	ABOVE FINISHED FLOOR	MAX	MAXIMUM
AFG	ABOVE FINISHED GRADE	MCA	MINIMUM CIRCUIT AMPACITY
AHU	AIR HANDLING UNIT	MCB	MAIN CIRCUIT BREAKER
APPROX	APPROXIMATELY	MDP	MAIN DISTRIBUTION PANEL
AS	AMP SWITCH OR AMMETER SWITCH	MDS	MAIN DISTRIBUTION SWITCHBOARD
AT	AMP TRIP OR AMP TAP	MCC	MOTOR CONTROL CENTER
@	AT	MH	MANHOLE OR METAL HALIDE
ATC	AUTOMATIC TEMPERATURE CONTROL	MIN	MINIMUM
ATS	AUTOMATIC TRANSFER SWITCH	MISC	MISCELLANEOUS
AWG	AMERICAN WIRE GAGE	MLO	MAIN LUGS ONLY
BFC	BELOW FINISHED CEILING	NL	NORMALLY CLOSED
BFG	BELOW FINISHED GRADE	NE	NORMAL EMERGENCY
C	CONDUIT	NEC	NATIONAL ELECTRICAL CODE
CATV	COMMUNITY ANTENNA TELEVISION SYSTEM	NF	NON FUSED
CB	CIRCUIT BREAKER	NFS	NON FUSED SWITCH
CCTV	CLOSED CIRCUIT TV	NO	NORMALLY OPEN
CL	CENTERLINE	NPS	NOT TO SCALE
CLG	CEILING	OCP	OVERCURRENT PROTECTIVE DEVICE
CUH	CABINET UNIT HEATER	OHD	OVERHEAD DOOR
DWG	DRAWING	P	POLE(S) OR PILOT
DWN	DOWN	PF	POWER FACTOR
EA	EACH	PIV	POST INDICATOR VALVE
EC	ELECTRICAL CONTRACTOR OR EMERGENCY CRITICAL	PL	PILOT LIGHT
EE	EMERGENCY EQUIPMENT	PNL	PANELBOARD
EF	EXHAUST FAN	PP	POWER PANEL
ELR	END OF LINE RESISTOR	PR	PAIR
EM OR EMER	EMERGENCY	PRI	PRIMARY
EMT	ELECTRICAL METALLIC TUBING	PVC	POLYVINYL CHLORIDE
ETR	EXISTING TO REMAIN	RECP	RECEPTACLE
EX	EXISTING (EXISTS)	REV	REVISION
EW	ELECTRIC WATER COOLER	RTU	ROOF TOP UNIT
FA	FIRE ALARM / FEEDER AMPLIFIER	SEC	SECONDARY
FCU	FAN COIL UNIT	SMR	SURFACE MOUNTED RACEWAY
GC	GENERAL CONTRACTOR	SPD	SURGE PROTECTIVE DEVICE
GEN	GENERATOR	SPECS	SPECIFICATIONS
GFI	GROUND FAULT INTERRUPTER	SW	SWITCH
GRD	GROUND	SWBD	SWITCHBOARD
HP	HORSEPOWER	SWGR	SWITCHGEAR
HZ	FREQUENCY IN CYCLES PER SECOND	TV	TELEVISION
JB	JUNCTION BOX	UNO	UNLESS NOTED OTHERWISE
KCMIL	THOUSAND CIRCULAR MILS	UPS	UNINTERRUPTIBLE POWER SUPPLY
KV	KILOVOLT	V	VOLT
KVA	KILOVOLT AMPERES	W	WIRE
		WF	WEATHERPROOF
		XFMR	TRANSFORMER

VOLTAGE DROP NOTE:
 THE FOLLOWING LIST APPLIES TO ALL NEW BRANCH WIRING PROVIDED UNDER THIS CONTRACT. LISTS INDICATE THE NECESSARY GAUGE OF CONDUCTORS NECESSARY FOR BRANCH CIRCUITS ONE WAY FROM PANEL TO LAST OUTLET OR LIGHTING FIXTURE ON THE CIRCUIT:

120/208V CIRCUITS	WIRE SIZE	277V CIRCUITS
• 0 - 100 FEET	No. 12 AWG	0 - 150 FEET
• 101 - 250 FEET	No. 10 AWG	151 - 350 FEET
• 250 - 400 FEET	No. 8 AWG	351 - 500 FEET

GENERAL NOTES - ELECTRICAL

- THE CONTRACTOR SHALL DISCONNECT, REMOVE, RELOCATE, AND RECONNECT AS NECESSARY ALL EXISTING ELECTRICAL EQUIPMENT CIRCUITS AND CONDUCTORS THROUGHOUT THE RENOVATED AREAS OF THE EXISTING BUILDING THAT INTERFERE WITH THE INSTALLATION OF THE NEW EQUIPMENT BEING INSTALLED. MAINTAIN THE CONTINUITY OF ALL EXISTING SYSTEMS AND WIRING. ALL WORK RELATED TO MODIFICATIONS TO ANY EXISTING ELECTRICAL SYSTEM SHALL BE COORDINATED WITH THE ENGINEER.
- ALL ELECTRICAL WORK SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST NATIONAL ELECTRICAL CODE AND ALL APPLICABLE FEDERAL, STATE, AND LOCAL CODES.
- ALL WIRE, CONDUIT, CONNECTORS, OUTLET BOXES, ETC. NECESSARY TO ACHIEVE A COMPLETE ELECTRICAL INSTALLATION WHERE AN ELECTRICAL DEVICE IS REQUIRED BY CODE BUT NOT SHOWN SHALL BE FURNISHED AND INSTALLED AS THOUGH FULLY SHOWN AND SPECIFIED.
- ALL CONDUIT, JUNCTION BOXES, ETC. ABOVE CEILINGS SHALL BE SUPPORTED FROM THE BUILDING DECK, AS PER SPECIFICATIONS.
- NEW OPENINGS, CHASES IN WALLS, FLOORS AND PARTITIONS FOR CONDUIT, HANGERS, SUPPORTS AND OTHER EQUIPMENT IN THE EXISTING BUILDING SHALL BE PROVIDED AS REQUIRED FOR THE NEW AND REMODELED INSTALLATION. NEW OPENINGS IN EXISTING CONSTRUCTION AND THE REPAIR OF SUCH OPENINGS FOR THE ENTRANCE OF NEW EQUIPMENT INTO THE BUILDING OR FOR THE REMOVAL OF EXISTING EQUIPMENT IN THE EXISTING BUILDING SHALL BE PROVIDED BY THE CONTRACTOR.
- NO CUTTING OF BUILDING CONSTRUCTION SHALL BE DONE WHICH MAY IN ANYWAY AFFECT THE BUILDING STRUCTURALLY OR ARCHITECTURALLY WITHOUT FIRST SECURING THE ENGINEERS CONSENT AND APPROVAL.
- NO CONDUITS SHALL BE RUN THROUGH OR SUPPORTED FROM DUCTWORK.
- ANY EXISTING WIRING WHICH IS ALTERED IN THE EXISTING BUILDING DUE TO THE WORK UNDER THIS CONTRACT SHALL BE MADE ELECTRICALLY CONTINUOUS. WHERE THE REMOVAL OF EXISTING DEVICES OR EQUIPMENT OCCURS IN THE BEGINNING OR THE MIDDLE OF A CIRCUIT, THE ELECTRICAL CONTRACTOR (EC) SHALL PROVIDE NEW BOXES, CONDUITS, CONDUCTORS, ETC. REQUIRED TO MAINTAIN THE CONTINUITY OF THE AFFECTED CIRCUIT. IT IS CALLED TO THE EC'S ATTENTION THAT FOR ANY OF THE EXISTING RECEPTABLES BRANCH CIRCUITS THAT ARE FED WITH CONDUITS IN THE FLOOR SLAB, THE NEW BOXES WILL NEED TO BE INSTALLED BELOW THE SLAB AND EXISTING CONDUITS AND CONDUCTORS EXTENDED DOWN INTO THE NEW BOXES AND JOINED TOGETHER. NEW OPENINGS IN THE EXISTING FLOOR SLAB SHALL BE GROUDED SHUT BY THE EC. THE COMPLETE INSTALLATION SHALL BE AS APPROVED BY THE ENGINEER.
- ALL EXISTING AREAS WHICH ARE DAMAGED BECAUSE OF THE ELECTRICAL WORK UNDER THIS CONTRACT SHALL BE REPAIRED AND/OR REFINISHED. THE CONTRACTOR WILL BE RESPONSIBLE FOR ALL CUTTING, PATCHING, PAINTING AND REMOVING/REPLACING CEILING TILES DAMAGED OR SOILED AS IS NECESSARY FOR HIS WORK.
- ALL ELECTRICAL WORK, WIRING, CONNECTIONS AND ASSOCIATED EQUIPMENT WITHIN THE AREA OF WORK SHALL BE AS PER APPLICABLE ARTICLES OF THE NATIONAL ELECTRICAL CODE. COORDINATE WITH SPECIFICATIONS FOR DEVICE REQUIREMENTS.
- THE CONTRACTOR SHALL PATCH AND FINISH ALL UNUSED OPENINGS AND DISTURBED SURFACES IN EXISTING BUILDING CONSTRUCTION RESULTING FROM THE REMOVAL OF ELECTRICAL EQUIPMENT UNDER THIS CONTRACT. ALL PATCHING AND FINISHING WORK SHALL BE APPROVED BY THE ARCHITECT.
- THE ENTIRE INSTALLATION MUST BE GROUNDED IN COMPLIANCE WITH THE NATIONAL ELECTRICAL CODE. ALL DEVICES, EQUIPMENT BOXES, ETC. MUST BE CONNECTED TO A SOLID, INSULATED GREEN, COPPER GROUNDING CONDUCTOR. THIS GROUNDING CONDUCTOR MUST BE CONTINUOUS WITHOUT SPLICES FROM POINT OF ORIGIN IN PANELBOARD TO ALL BOXES AND EQUIPMENT ON EACH BRANCH CIRCUIT. VERIFY GROUNDING VALUES AND SUBMIT A TYPEWRITTEN REPORT TO THE ENGINEER INDICATING TESTING RESULTS OF EACH CIRCUIT AT THE COMPLETION OF THE PROJECT.
- WIRING FOR 20A CIRCUITS SHALL BE (2)#12 AWG & (1)#12 AWG GROUND IN 3/4" CONDUIT, UNLESS NOTED OTHERWISE. FOR SINGLE PHASE CIRCUITS AND (3)#12 AWG & (1)#12 AWG GROUND IN 3/4", UNLESS NOTED OTHERWISE, FOR THREE PHASE CIRCUITS. FOR CIRCUITS THAT REQUIRE LONG TRAVEL DISTANCES, REFER TO VOLTAGE DROP NOTE BELOW.
- ALL NEW CONDUITS INSTALLED UNDER THIS PROJECT MUST BE INSTALLED AS HIGH AS POSSIBLE ON THE UNDERSIDE OF EXISTING AND NEW FLOOR CONSTRUCTION AND INSTALLED AROUND EXISTING BEAMS.
- THIS CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING BID AND MAKE HIMSELF/HERSELF AWARE OF ANY CONDITIONS WHICH MAY IN ANY WAY AFFECT HIS/HER WORK. FAILURE TO VISIT AND OBSERVE THESE CONDITIONS DOES NOT EXCUSE CONTRACTOR FROM THE RESPONSIBILITIES OF INFORMING THE OWNER AND INCLUDING ALL CONDITIONS IN HIS/HER BID WORK.
- OPENINGS LEFT AFTER THE REMOVAL OF EXISTING ELECTRICAL CONDUITS ETC. SHALL BE PATCHED AND REPAIRED TO MATCH THE ADJACENT MATERIALS INCLUDING ALL OPENINGS REMAINING FROM PREVIOUS PROJECTS. LOCATIONS TO BE VERIFIED IN FIELD.
- THE CONTRACTOR SHALL FIRESTOP ALL EXISTING CONCEALED AND ACCESSIBLE CONDUITS WITHIN THE LIMITS OF THE CONTRACT WORK AREA. THE CONTRACTOR SHALL FIRESTOP ALL NEW AND EXISTING CONDUITS AS PART OF THE REMODELING AND EXISTING SYSTEMS TO REMAIN. (REFER TO SPECIFICATIONS)
- THE CONTRACTOR SHALL PROVIDE AND INSTALL APPROVED FIRE STOPPING AT ALL NEW AND EXISTING FLOOR SLAB/CEILING AND WALL PENETRATIONS WITHIN THE LIMITS OF CONTRACT WORK AREA TO MAINTAIN THE FIRE RATED CONSTRUCTION.
- DURING DEMOLITION, THE CONTRACTOR SHALL ASSUME EXISTING LIGHTING BALLASTS CONTAIN PCBs AND MUST BE RECYCLED IN ACCORDANCE WITH STATE AND FEDERAL LAWS. PROVIDE OWNER A RECEIPT FROM RECYCLING FACILITY.
- THE WORD PROVIDED IN THIS DOCUMENT SET MEANS TO PROVIDE AND INSTALL COMPLETE SYSTEMS.
- THE CONTRACTOR SHALL RECYCLE ALL LAMPS IN ACCORDANCE WITH STATE AND FEDERAL LAWS. PROVIDE OWNER A RECEIPT FROM RECYCLING FACILITY.

Consultants:

Consultants:

Seal:



Seal:

Project Identity:

COMMUNITY COLLEGE OF ALLEGHENY COUNTY ALLEGHENY CAMPUS K. LEROY IRVIS SCIENCE CENTER

LAB REFRIGERATOR POWER

808 RIDGE AVE. PITTSBURGH, PA 15212

No.:	Date:	Description:

Sheet Title:
SYMBOLS, NOTES, AND ABBREVIATIONS

Project No.: 2025-1929.01

Cadd Drawing File: 1255-SC-XP-E001.dwg

Drawn By: AJP/NAW

Checked By: CVU

Date: 02/12/2026

Drawing Number

E001

Sheet 01 of 09

KEYNOTES THIS DRAWING

- GENERAL NOTES:**
1. WITHIN THE RENOVATION AREA, THE ELECTRICAL CONTRACTOR SHALL DISCONNECT AND REMOVE AS INDICATED AND TO INCLUDE, RACEWAYS AND JUNCTION BOXES, CONDUCTORS, CABLES, ELECTRICAL CONNECTIONS, ETC.
 2. ALL EXISTING OUTLETS SHOWN AS DEMOLISHED SHALL HAVE BRANCH CIRCUITS, PULLED ABOVE CEILING AND PROTECTED FOR REUSE, UNLESS OTHERWISE NOTED.
 3. NOT ALL DEMOLITION DEVICES SHOWN - FIELD VERIFY.
 4. THE CONTRACTOR SHALL VISIT THE FACILITY AND MAKE THEMSELVES AWARE OF ANYTHING WHICH MAY AFFECT THEIR WORK PRIOR TO SUBMITTING BIDS. ALERT ENGINEER / ARCHITECT IN WRITING OF ANY OBSERVED CONDITION WHICH MAY AFFECT CONTRACTORS WORK PRIOR TO SUBMITTING BID.

Consultants:

Consultants:

Seal:



Seal:

Project Identification:

**COMMUNITY COLLEGE
OF ALLEGHENY
COUNTY
ALLEGHENY CAMPUS
K. LEROY IRVIS
SCIENCE CENTER**

**LAB REFRIGERATOR
POWER**

**808 RIDGE AVE.
PITTSBURGH, PA
15212**

No.: Date: Description:

No.:	Date:	Description:

Sheet Title:
**FIRST FLOOR
PLAN**

Project No.: 2025-1929.01

Cadd Drawing File: 1255-SC-XP-E101.dwg

Drawn By: AJP/NAW

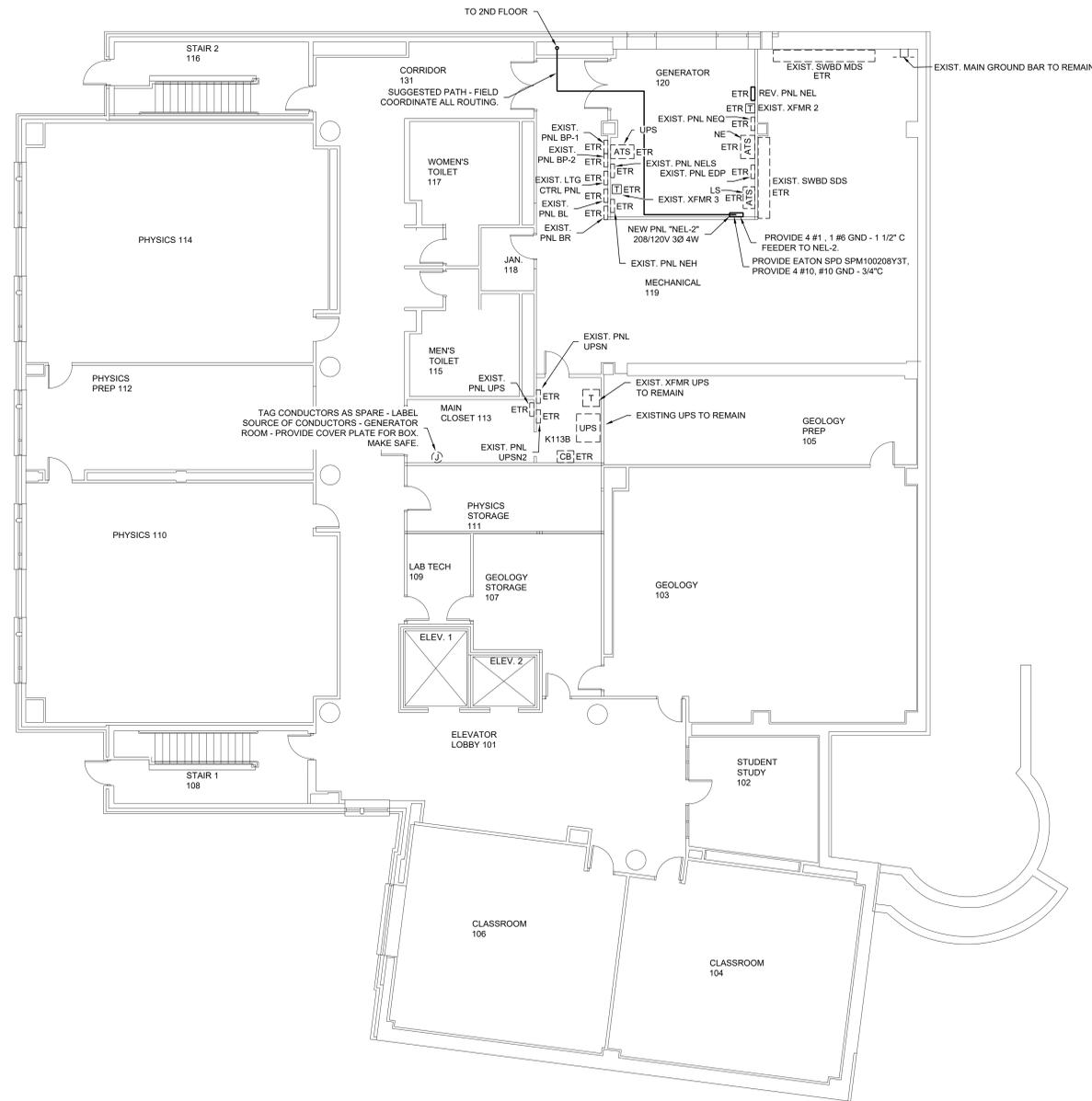
Checked By: CVU

Date: 02/12/2026

Drawing Number

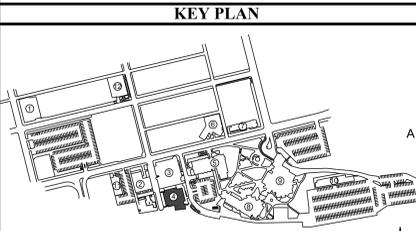
E101

Sheet 02 of 09



1 FIRST FLOOR PLAN
Scale: 1/8" = 1'-0"

**CONTRACTOR SHALL
CONFIRM ALL RECEPTACLE
LOCATIONS WITH CCAC PM
PRIOR TO ROUGH IN**



BUILDING LEGEND

1. OCS	7. JONES HALL
2. BYRDS HALL	8. MILTON HALL
3. PHYS EDUCATION BLDG	9. LIBRARY
4. SCIENCE CENTER	10. PHYSICAL PLANT
5. STUDENT SERVICE CENTER	11. 313 RIDGE
6. WEST HALL	12. VISUAL ARTS CENTER

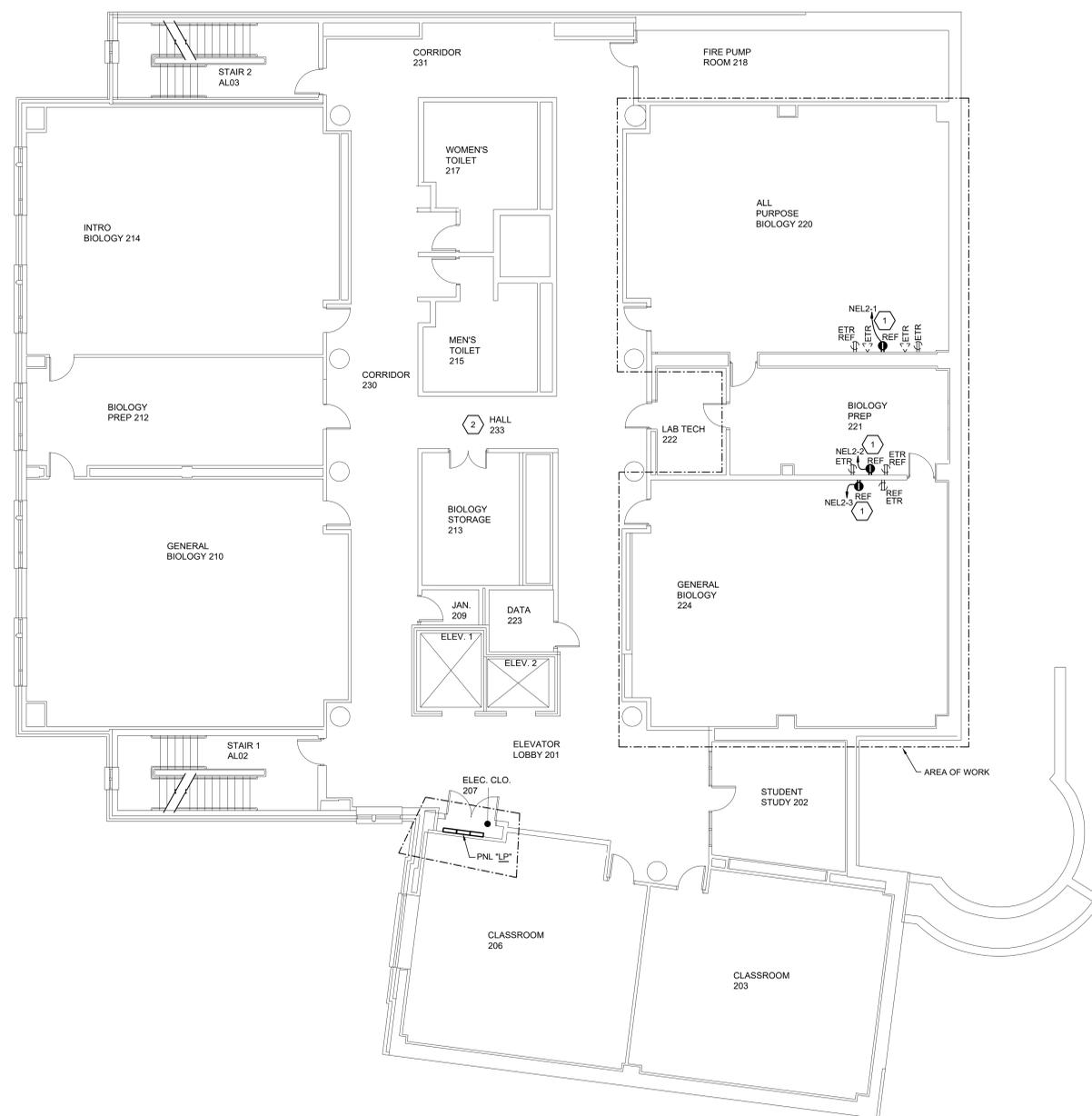


KEYNOTES THIS DRAWING

- 1 PROVIDE RED DEVICE AND FACEPLATE, TAG WITH CIRCUIT NUMBER.
- 2 WHERE CONDUITS ARE EXPOSED IN CORRIDORS, PAINT BLACK.

GENERAL NOTES:

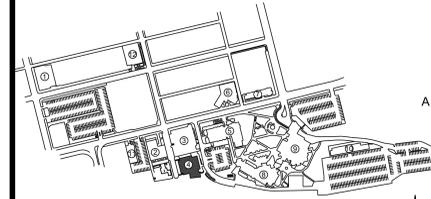
1. WITHIN THE RENOVATION AREA, THE ELECTRICAL CONTRACTOR SHALL DISCONNECT AND REMOVE AS INDICATED AND TO INCLUDE, RACEWAYS AND JUNCTION BOXES, CONDUCTORS, CABLES, ELECTRICAL CONNECTIONS, ETC.
2. ALL EXISTING OUTLETS SHOWN AS DEMOLISHED SHALL HAVE BRANCH CIRCUITS, PULLED ABOVE CEILING AND PROTECTED FOR REUSE, UNLESS OTHERWISE NOTED.
3. NOT ALL DEMOLITION DEVICES SHOWN - FIELD VERIFY.
4. THE CONTRACTOR SHALL VISIT THE FACILITY AND MAKE THEMSELVES AWARE OF ANYTHING WHICH MAY AFFECT THEIR WORK PRIOR TO SUBMITTING BIDS. ALERT ENGINEER / ARCHITECT IN WRITING OF ANY OBSERVED CONDITION WHICH MAY AFFECT CONTRACTORS WORK PRIOR TO SUBMITTING BID.



1 SECOND FLOOR PLAN
Scale: 1/8" = 1'-0"
0 4' 8' 16'

CONTRACTOR SHALL CONFIRM ALL RECEPTACLE LOCATIONS WITH CCAC PM PRIOR TO ROUGH IN

KEY PLAN



BUILDING LEGEND	
1. OCS	7. JONES HALL
2. BYRDS HALL	8. MILFORD HALL
3. PHYS EDUCATION BLDG	9. LIBRARY
4. SCIENCE CENTER	10. PHYSICAL PLANT
5. STUDENT SERVICE CENTER	11. 915 RIDGE
6. WEST HALL	12. VISUAL ARTS CENTER

CCAC NORTH SIDE CAMPUS MAP
SCALE: 1/8" = 1'-0"

Consultants:

Consultants:

Seal:



Seal:

Project Identification:

COMMUNITY COLLEGE OF ALLEGHENY COUNTY ALLEGHENY CAMPUS K. LEROY IRVIS SCIENCE CENTER

LAB REFRIGERATOR POWER

808 RIDGE AVE. PITTSBURGH, PA 15212

No.: Date: Description:

Sheet Title:
SECOND FLOOR MEZZANINE AND SECOND FLOOR PLAN

Project No.: 2025-1929.01

Cadd Drawing File: 1255-SC-XP-E102.dwg

Drawn By: AJP/NAW

Checked By: CVU

Date: 02/12/2026

Drawing Number

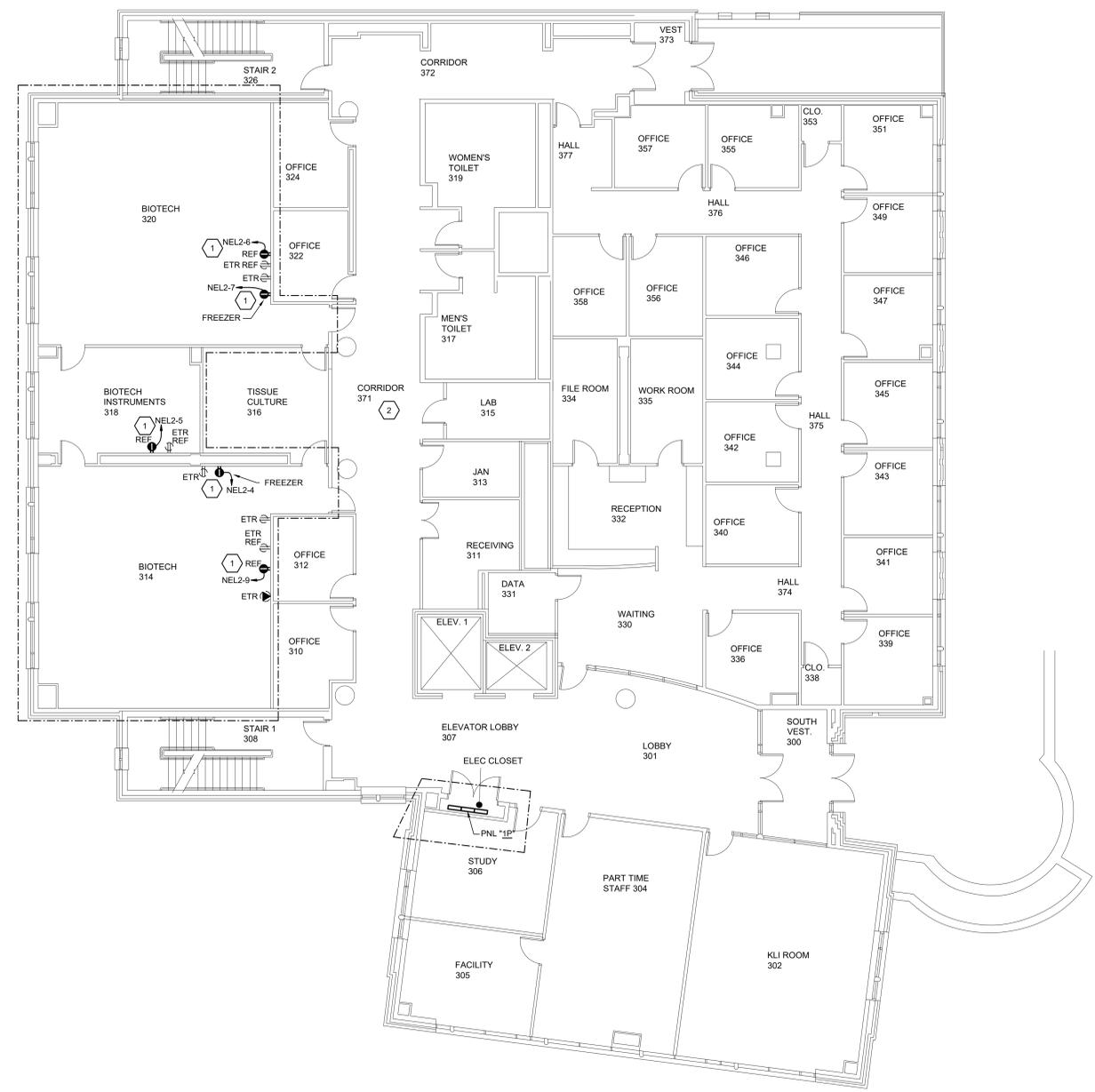
E102

Sheet 03 of 09

KEYNOTES THIS DRAWING

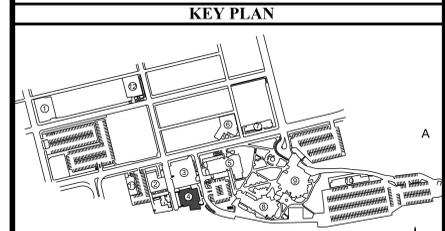
- 1 PROVIDE RED DEVICE AND FACEPLATE, TAG WITH CIRCUIT NUMBER.
- 2 WHERE CONDUITS ARE EXPOSED IN CORRIDORS, PAINT BLACK.

- GENERAL NOTES:**
- WITHIN THE RENOVATION AREA, THE ELECTRICAL CONTRACTOR SHALL DISCONNECT AND REMOVE AS INDICATED AND TO INCLUDE, RACEWAYS AND JUNCTION BOXES, CONDUCTORS, CABLES, ELECTRICAL CONNECTIONS, ETC.
 - ALL EXISTING OUTLETS SHOWN AS DEMOLISHED SHALL HAVE BRANCH CIRCUITS, PULLED ABOVE CEILING AND PROTECTED FOR REUSE, UNLESS OTHERWISE NOTED.
 - NOT ALL DEMOLITION DEVICES SHOWN - FIELD VERIFY.
 - THE CONTRACTOR SHALL VISIT THE FACILITY AND MAKE THEMSELVES AWARE OF ANYTHING WHICH MAY AFFECT THEIR WORK PRIOR TO SUBMITTING BIDS. ALERT ENGINEER / ARCHITECT IN WRITING OF ANY OBSERVED CONDITION WHICH MAY AFFECT CONTRACTORS WORK PRIOR TO SUBMITTING BID.



1 THIRD FLOOR PLAN
Scale: 1/8" = 1'-0"
0 4' 8' 16'

CONTRACTOR SHALL CONFIRM ALL RECEPTACLE LOCATIONS WITH CCAC PM PRIOR TO ROUGH IN



BUILDING LEGEND

1. OCS	7. JONES HALL
2. BYRDS HALL	8. MILTON HALL
3. PHYS EDUCATION BLDG	9. LIBRARY
4. SCIENCE CENTER	10. PHYSICAL PLANT
5. STUDENT SERVICE CENTER	11. 813 RIDGE
6. WEST HALL	12. VISUAL ARTS CENTER



Consultants:

Consultants:

Seal:



Seal:

Project Identification:

COMMUNITY COLLEGE OF ALLEGHENY COUNTY ALLEGHENY CAMPUS K. LEROY IRVIS SCIENCE CENTER

LAB REFRIGERATOR POWER

808 RIDGE AVE. PITTSBURGH, PA 15212

No.: Date: Description:

No.	Date	Description

Sheet Title:
THIRD FLOOR PLAN

Project No.: 2025-1929.01

Cadd Drawing File: 1255-SC-XP-E103.dwg

Drawn By: AJP/NAW

Checked By: CVU

Date: 02/12/2026

Drawing Number

E103

Sheet 04 of 09

KEYNOTES THIS DRAWING

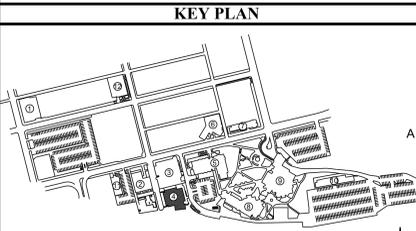
- 1 PROVIDE RED DEVICE AND FACEPLATE, TAG WITH CIRCUIT NUMBER.
- 2 WHERE CONDUITS ARE EXPOSED IN CORRIDORS, PAINT BLACK.

- GENERAL NOTES:**
1. WITHIN THE RENOVATION AREA, THE ELECTRICAL CONTRACTOR SHALL DISCONNECT AND REMOVE AS INDICATED AND TO INCLUDE, RACEWAYS AND JUNCTION BOXES, CONDUCTORS, CABLES, ELECTRICAL CONNECTIONS, ETC.
 2. ALL EXISTING OUTLETS SHOWN AS DEMOLISHED SHALL HAVE BRANCH CIRCUITS, PULLED ABOVE CEILING AND PROTECTED FOR REUSE, UNLESS OTHERWISE NOTED.
 3. NOT ALL DEMOLITION DEVICES SHOWN - FIELD VERIFY.
 4. THE CONTRACTOR SHALL VISIT THE FACILITY AND MAKE THEMSELVES AWARE OF ANYTHING WHICH MAY AFFECT THEIR WORK PRIOR TO SUBMITTING BIDS. ALERT ENGINEER / ARCHITECT IN WRITING OF ANY OBSERVED CONDITION WHICH MAY AFFECT CONTRACTORS WORK PRIOR TO SUBMITTING BID.



1 FOURTH FLOOR PLAN
Scale: 1/8" = 1'-0"

CONTRACTOR SHALL CONFIRM ALL RECEPTACLE LOCATIONS WITH CCAC PM PRIOR TO ROUGH IN



BUILDING LEGEND

1. OCS	7. JONES HALL
2. BYRNES HALL	8. MILSON HALL
3. PHYS EDUCATION BLDG	9. LIBRARY
4. SCIENCE CENTER	10. PHYSICAL PLANT
5. STUDENT SERVICE CENTER	11. 11TH RIDGE
6. WEST HALL	12. VISUAL ARTS CENTER

Consultants:

Consultants:

Seal:



Seal:

Project Identification:

COMMUNITY COLLEGE OF ALLEGHENY COUNTY ALLEGHENY CAMPUS K. LEROY IRVIS SCIENCE CENTER

LAB REFRIGERATOR POWER

808 RIDGE AVE. PITTSBURGH, PA 15212

No.	Date	Description

Sheet Title:
FOURTH FLOOR PLAN

Project No.: 2025-1929.01

Cadd Drawing File: 1255-SC-XP-E104.dwg

Drawn By: AJP/NAW

Checked By: CVU

Date: 02/12/2026

Drawing Number

E104

Sheet 05 of 09

Consultants:

Consultants:

Seal:



Seal:

Project Identification:

COMMUNITY COLLEGE OF ALLEGHENY COUNTY ALLEGHENY CAMPUS K. LEROY IRVIS SCIENCE CENTER

LAB REFRIGERATOR POWER

808 RIDGE AVE. PITTSBURGH, PA 15212

No.: Date: Description:

Sheet Title:
EXISTING PANEL SCHEDULES

Project No.: 2025-1929.01

Cadd Drawing File: 1255-SC-XP-E601.dwg

Drawn By: AJP/NAW

Checked By: CVU

Date: 02/12/2026

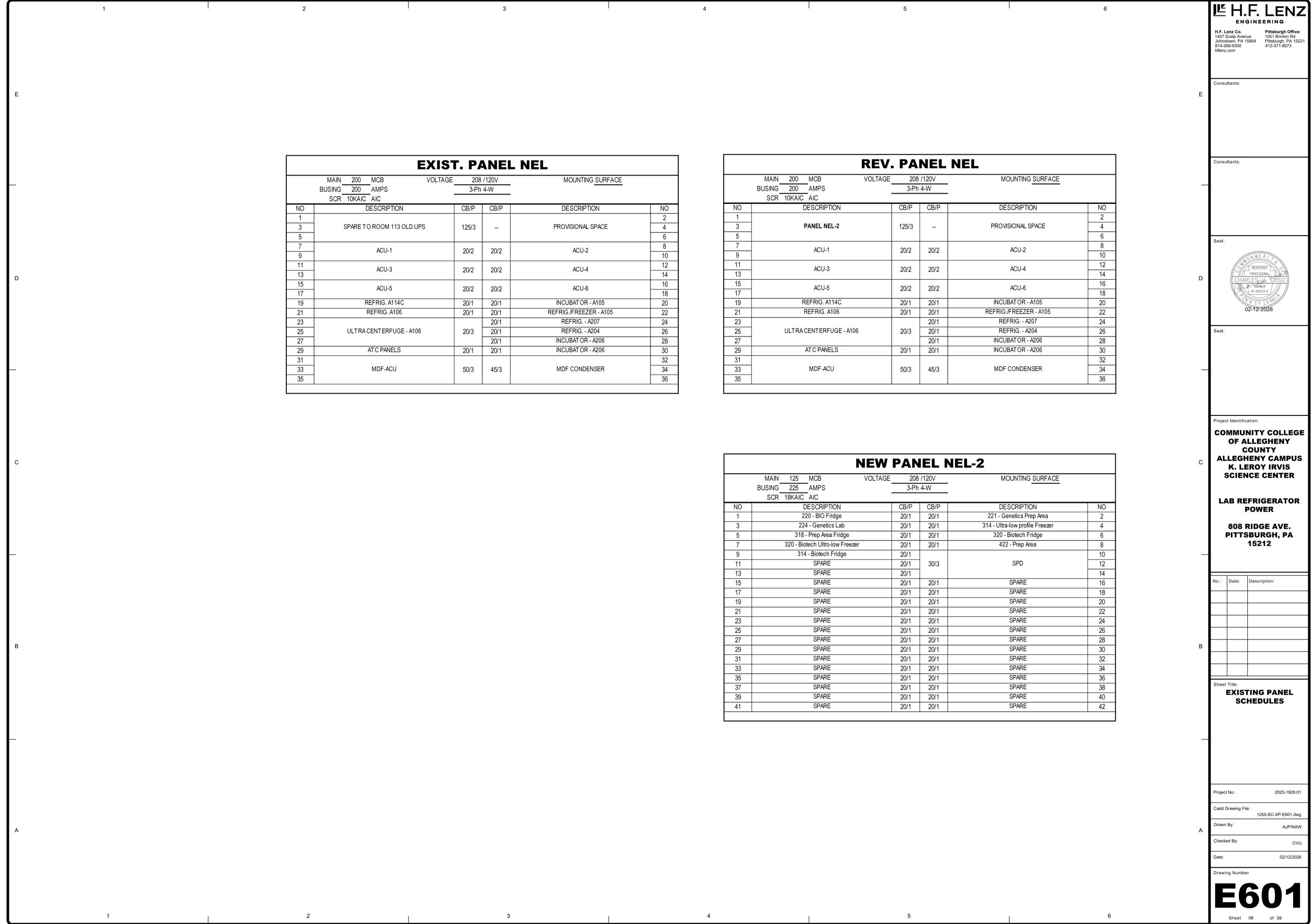
Drawing Number

E601
Sheet 08 of 09

EXIST. PANEL NEL					
MAIN 200 MCB		VOLTAGE 208 /120V		MOUNTING SURFACE	
BUSING 200 AMPS		3-Ph 4-W			
SCR 10KAIC AIC					
NO	DESCRIPTION	CB/P	CB/P	DESCRIPTION	NO
1	SPARE TO ROOM 113 OLD UPS	125/3	-	PROVISIONAL SPACE	2
3					4
5					6
7	ACU-1	20/2	20/2	ACU-2	8
9					10
11	ACU-3	20/2	20/2	ACU-4	12
13					14
15	ACU-5	20/2	20/2	ACU-6	16
17					18
19	REFRIG. A114C	20/1	20/1	INCUBATOR - A105	20
21	REFRIG. A106	20/1	20/1	REFRIG./FREEZER - A105	22
23	ULTRACENTERFUGE - A106	20/3		REFRIG. - A207	24
25				REFRIG. - A204	26
27				INCUBATOR - A206	28
29	ATC PANELS	20/1	20/1	INCUBATOR - A206	30
31					32
33	MDF-ACU	50/3	45/3	MDF CONDENSER	34
35					36

REV. PANEL NEL					
MAIN 200 MCB		VOLTAGE 208 /120V		MOUNTING SURFACE	
BUSING 200 AMPS		3-Ph 4-W			
SCR 10KAIC AIC					
NO	DESCRIPTION	CB/P	CB/P	DESCRIPTION	NO
1	PANEL NEL-2	125/3	-	PROVISIONAL SPACE	2
3					4
5					6
7	ACU-1	20/2	20/2	ACU-2	8
9					10
11	ACU-3	20/2	20/2	ACU-4	12
13					14
15	ACU-5	20/2	20/2	ACU-6	16
17					18
19	REFRIG. A114C	20/1	20/1	INCUBATOR - A105	20
21	REFRIG. A106	20/1	20/1	REFRIG./FREEZER - A105	22
23	ULTRACENTERFUGE - A106	20/3		REFRIG. - A207	24
25				REFRIG. - A204	26
27				INCUBATOR - A206	28
29	ATC PANELS	20/1	20/1	INCUBATOR - A206	30
31					32
33	MDF-ACU	50/3	45/3	MDF CONDENSER	34
35					36

NEW PANEL NEL-2					
MAIN 125 MCB		VOLTAGE 208 /120V		MOUNTING SURFACE	
BUSING 225 AMPS		3-Ph 4-W			
SCR 18KAIC AIC					
NO	DESCRIPTION	CB/P	CB/P	DESCRIPTION	NO
1	220 - BIO Fridge	20/1	20/1	221 - Genetics Prep Area	2
3	224 - Genetics Lab	20/1	20/1	314 - Ultra-low profile Freezer	4
5	318 - Prep Area Fridge	20/1	20/1	320 - Biotech Fridge	6
7	320 - Biotech Ultra-low Freezer	20/1	20/1	422 - Prep Area	8
9	314 - Biotech Fridge	20/1			10
11	SPARE	20/1	30/3	SPD	12
13	SPARE	20/1			14
15	SPARE	20/1	20/1	SPARE	16
17	SPARE	20/1	20/1	SPARE	18
19	SPARE	20/1	20/1	SPARE	20
21	SPARE	20/1	20/1	SPARE	22
23	SPARE	20/1	20/1	SPARE	24
25	SPARE	20/1	20/1	SPARE	26
27	SPARE	20/1	20/1	SPARE	28
29	SPARE	20/1	20/1	SPARE	30
31	SPARE	20/1	20/1	SPARE	32
33	SPARE	20/1	20/1	SPARE	34
35	SPARE	20/1	20/1	SPARE	36
37	SPARE	20/1	20/1	SPARE	38
39	SPARE	20/1	20/1	SPARE	40
41	SPARE	20/1	20/1	SPARE	42



Consultants:

Consultants:

Seal:



Seal:

Project Identification:

**COMMUNITY COLLEGE
OF ALLEGHENY
COUNTY
ALLEGHENY CAMPUS
K. LEROY IRVIS
SCIENCE CENTER**

**LAB REFRIGERATOR
POWER**

**808 RIDGE AVE.
PITTSBURGH, PA
15212**

No.: Date: Description:

No.	Date	Description

Sheet Title:

EXISTING RISER

Project No.: 2025-1929.01

Cadd Drawing File: 1255-SC-XP-E701.dwg

Drawn By: AJP/NAW

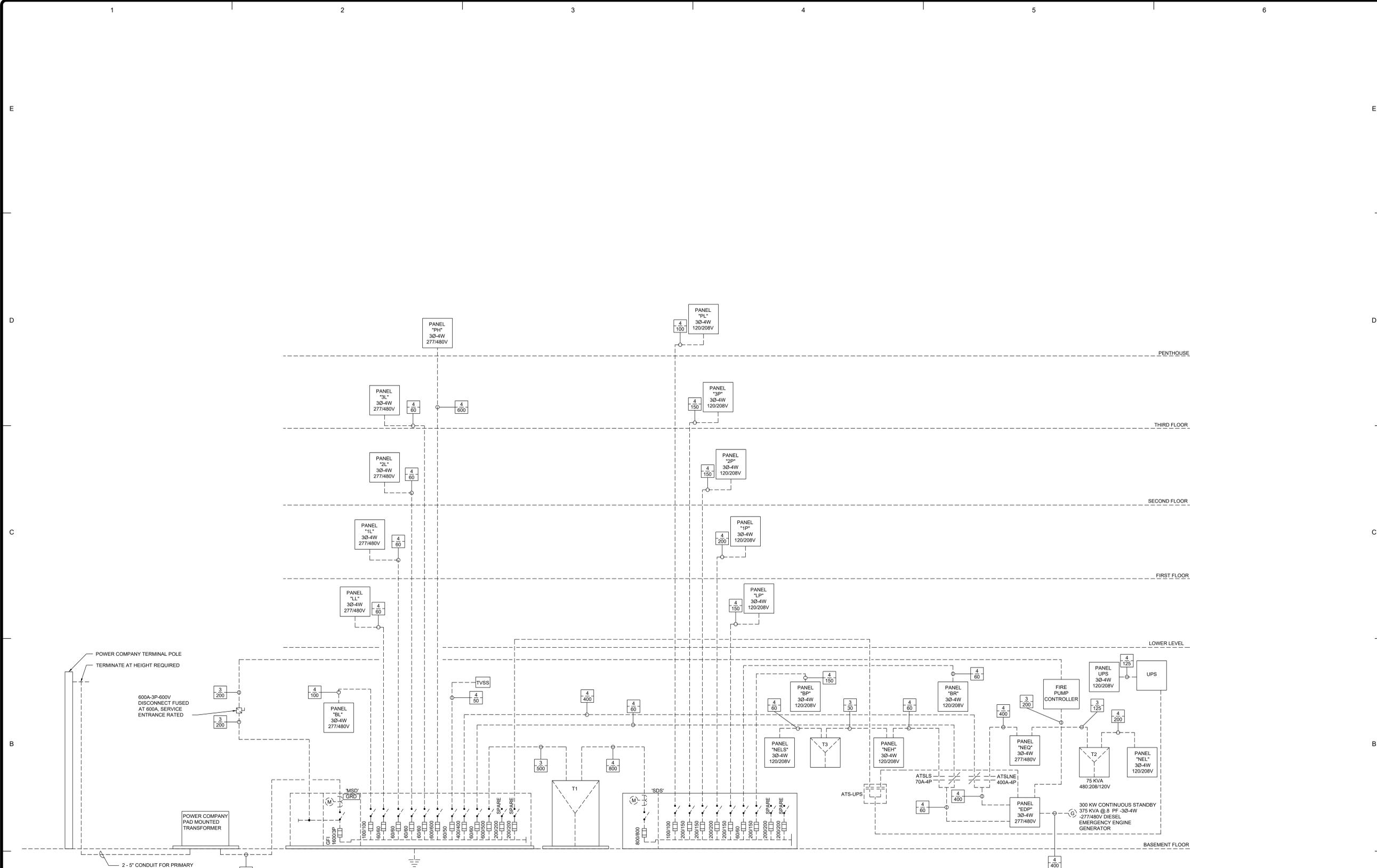
Checked By: CVU

Date: 02/12/2026

Drawing Number

E701

Sheet 09 of 09



1 EXISTING RISER
Scale: N.T.S.

FEEDER SCHEDULE				
	TYPE 1	TYPE 2	TYPE 3	TYPE 4
3	1Ø-3W & GND	1Ø-3W & GND	3Ø-3W & GND	3Ø-4W & GND
200	SINGLE POLE OR TWO POLE	TWO POLE W/ NEUTRAL	THREE POLE	THREE POLE W/ NEUTRAL
100	2#1 & 1#GND in 1 1/4" C	3#1 & 1#GND in 1 1/4" C	3#1 & 1#GND in 1 1/4" C	4#1 & 1#GND in 1 1/2" C
110	2#1 & 1#GND in 1 1/4" C	3#1 & 1#GND in 1 1/4" C	3#1 & 1#GND in 1 1/4" C	4#1 & 1#GND in 1 1/2" C
125	2#1 & 1#GND in 1 1/4" C	3#1 & 1#GND in 1 1/4" C	3#1 & 1#GND in 1 1/4" C	4#1 & 1#GND in 1 1/2" C
150	2#1/Ø & 1#GND in 1 1/4" C	3#1/Ø & 1#GND in 1 1/2" C	3#1/Ø & 1#GND in 1 1/2" C	4#1/Ø & 1#GND in 2" C
175	2#2/Ø & 1#GND in 1 1/2" C	3#2/Ø & 1#GND in 2" C	3#2/Ø & 1#GND in 2" C	4#2/Ø & 1#GND in 2" C
200	2#3/Ø & 1#GND in 1 1/2" C	3#3/Ø & 1#GND in 2" C	3#3/Ø & 1#GND in 2" C	4#3/Ø & 1#GND in 2" C
225	2#4/Ø & 1#4GND in 2" C	3#4/Ø & 1#4GND in 2" C	3#4/Ø & 1#4GND in 2" C	4#4/Ø & 1#4GND in 2 1/2" C

Consultants:

Consultants:

Seal:



Seal:

Project Identification:

COMMUNITY COLLEGE OF ALLEGHENY COUNTY ALLEGHENY CAMPUS K. LEROY IRVIS SCIENCE CENTER

LAB REFRIGERATOR POWER

808 RIDGE AVE. PITTSBURGH, PA 15212

No.	Date	Description

Sheet Title:
NEW WORK RISER

Project No.: 2025-1929.01

Cadd Drawing File: 1255-SC-XP-E701.dwg

Drawn By: AJP/NAW

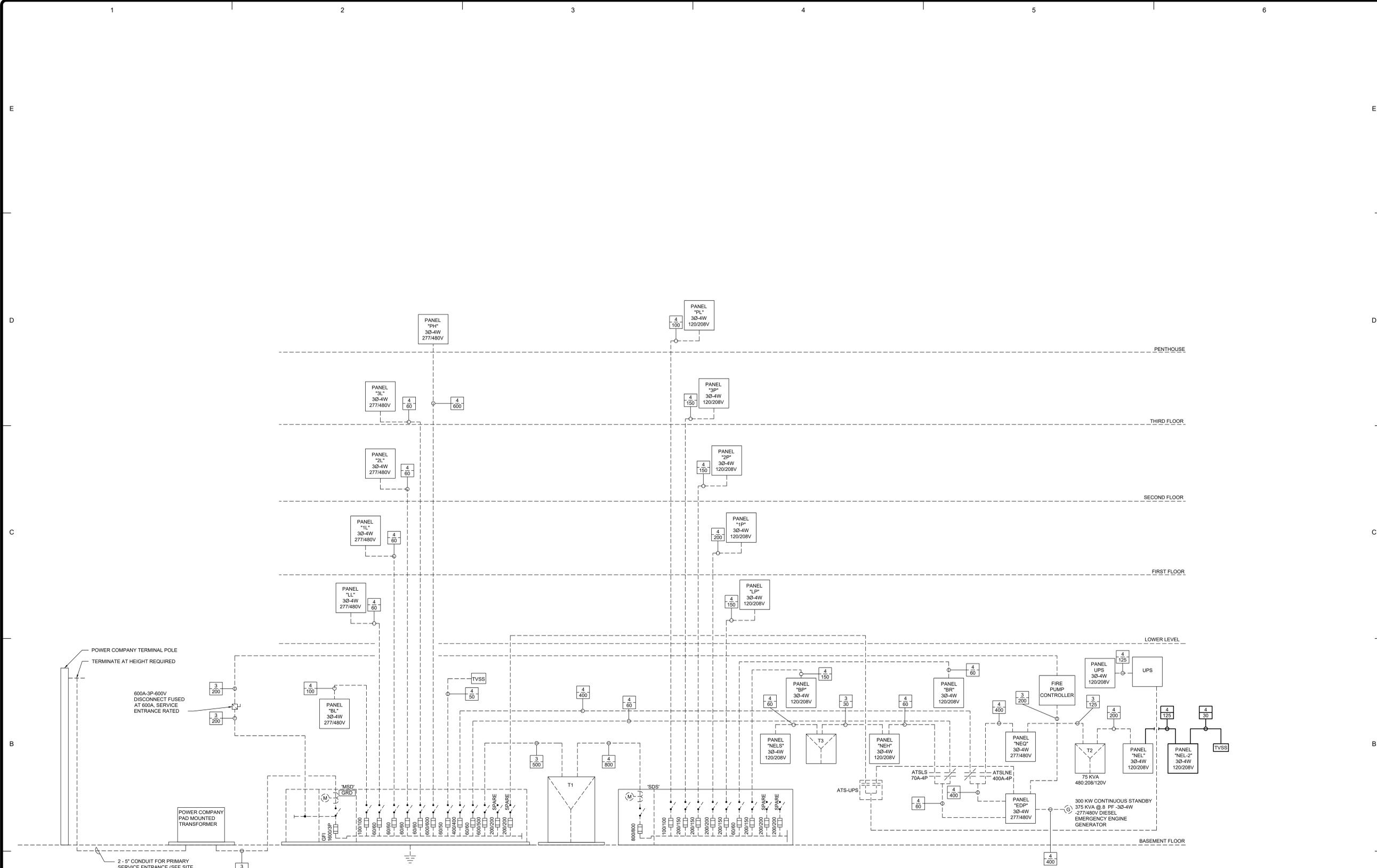
Checked By: CVU

Date: 02/12/2026

Drawing Number

E702

Sheet 09 of 09



1 NEW WORK RISER
Scale: N.T.S.

FEEDER SCHEDULE

	TYPE 1	TYPE 2	TYPE 3	TYPE 4
3	10-2W & GND	10-3W & GND	30-3W & GND	30-4W & GND
200	SINGLE POLE OR TWO POLE	TWO POLE W/ NEUTRAL	THREE POLE	THREE POLE W/ NEUTRAL
100	2#1 & 1#6GND in 1 1/4" c	3#1 & 1#6GND in 1 1/4" c	3#1 & 1#6GND in 1 1/4" c	4#1 & 1#6GND in 1 1/2" c
110	2#1 & 1#6GND in 1 1/4" c	3#1 & 1#6GND in 1 1/4" c	3#1 & 1#6GND in 1 1/4" c	4#1 & 1#6GND in 1 1/2" c
125	2#1 & 1#6GND in 1 1/4" c	3#1 & 1#6GND in 1 1/4" c	3#1 & 1#6GND in 1 1/4" c	4#1 & 1#6GND in 1 1/2" c
150	2#1/0 & 1#6GND in 1 1/4" c	3#1/0 & 1#6GND in 1 1/2" c	3#1/0 & 1#6GND in 1 1/2" c	4#1/0 & 1#6GND in 2" c
175	2#2/0 & 1#6GND in 1 1/2" c	3#2/0 & 1#6GND in 2" c	3#2/0 & 1#6GND in 2" c	4#2/0 & 1#6GND in 2" c
200	2#3/0 & 1#6GND in 1 1/2" c	3#3/0 & 1#6GND in 2" c	3#3/0 & 1#6GND in 2" c	4#3/0 & 1#6GND in 2" c
225	2#4/0 & 1#4GND in 2" c	3#4/0 & 1#4GND in 2" c	3#4/0 & 1#4GND in 2" c	4#4/0 & 1#4GND in 2 1/2" c