



KANSAS CITY KANSAS PUBLIC SCHOOLS / USD500

PURCHASING OFFICE | 2010 N. 59TH STREET ROOM 370 \ KANSAS CITY, KS66104

WEB SITE: WWW.KCKPS.ORG/PURCHASING

Electrical Service Main Replacement

BID No: IFB 20-008 **ISSUE DATE: March 4, 2020**

Kansas City Kansas Public Schools (KCKPS) will receive sealed bids, on this form at the Purchasing Office, 2010 N. 59th Street, Room 370, Kansas City, KS 66104 until **2:00 PM, March 19, 2020**, at which time bids received will be publicly opened and read, all in accordance with bid instructions, specifications and/or bid conditions attached hereto or as shown below.

PRE-BID MEETING: A pre-bid meeting will be held **March 11, 2020 @ 2:30PM:**

Eisenhower Middle School (East Side of Building)
2901 N 72nd Street
Kansas City, Kansas 66109

A site visit will follow the pre-bid meeting. Attendance is recommended, but not mandatory.

CONTACT:

Brian Hernandez, Assistant Director of Purchasing | (913) 279-2244 | eMail: brian.hernandez@kckps.org

All work is to be completed prior to July 31, 2020

Location of the Work

Eisenhower Middle School
2901 N 72nd Street
Kansas City, KS 66109

Bid Security

Bid security shall be submitted with each bid in the amount of five percent (5%) of the bid amount. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

Prevailing Wage

Prevailing Wage IS NOT required for this project.

Time of Completion

Successful bidder shall begin the Work on receipt of the Notice to Proceed and shall complete the Work (Substantial Completion) no later than **July 31, 2020**.

Liquidated Damages

Completion of this project before July 31, 2020 is imperative. At the District's sole discretion, liquidated damages per calendar day will be assessed against the Contract if the project is not completed by the date indicated.

Clean-Up

The Contractor will keep the premises free from accumulations of debris and waste materials caused by its employees in performance of the work. At completion of the project, Contractor shall remove all crating, packaging, waste and debris from the building and the site, and all tools, scaffolding and surplus materials, and shall leave the building and site "broom clean" or its equivalent.

Permits, Codes and Ordinances

Each Contractor shall file and pay for required permits affecting its work (if applicable). Each contractor shall conform to applicable codes and ordinances, including OSHA requirements.

Damage to District Property

Contractor at its own expense shall promptly remedy and repair all damages or loss to any property caused in whole or part by its employees, subcontractor(s), supplier or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable.

No Smoking: The District adheres to the mandatory "No Smoking" policy on school premises and/or at school functions. All bidders shall comply with this "No Smoking" policy.

INCLEMENT WEATHER OR EMERGENCY

IF THERE IS A BUILDING CLOSING THE DAY OF THE OPENING OF PROPOSALS DUE TO INCLEMENT WEATHER OR AN EMERGENCY, THE OPENING OF PROPOSALS WILL OCCUR AT 2:00PM (CENTRAL) THE NEXT BUSINESS DAY THE DISTRICT IS OPEN.

MATERIALS AND METHODS OF WORK

1. All work shall be done in accordance with the best trade practices. The Contractor shall comply with all applicable safety regulations for the protection of workman, pedestrians, and property. The Contractor shall maintain work area free of debris. All applicable State and local laws, ordinances, and codes shall apply to this service contract.
2. The Contractor shall be responsible for the protection of shrubs and grass during the projects and cleanup of the general area.
3. The Contractor and workman must park all vehicles in school's parking lots and in accordance with city and School District regulations. No parking on sidewalks or grass area adjoining the project site will be allowed.
4. The Contractor is cautioned that in addition there are direct burial utilities such as water, sewer, and gas, electrical main service and electrical service to outdoor lights.
5. The Contractor shall verify all dimensions before any materials, parts, or equipment is ordered for the project. All plan dimensions are approximate.
6. All work and materials performed under this service contract shall be guaranteed for a period of one (1) year from date of acceptance by School District.
7. The Contractor will clean, vacuum, mop, dust, and wash all areas where dirt and debris remain within the project area. All new construction debris will be removed daily by the Contractor.
8. The Contractor will be responsible for all damage to the existing building(s) and their contents within the area of work.

CUTTING AND PATCHING:

DESCRIPTION

- A. Cutting and patching includes cutting into existing construction to provide for installation or performance of other work and subsequent fitting and patching required to restore surface to their original condition.
- B. Cutting and patching is performed for coordination of the work to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed, or for other similar purposes.
- C. Drilling of holes to install fasteners and similar operation, and cutting and patching performed during the manufacture of products or initial fabrication, or erection of installation processes is to be considered as cutting and patching included in this Section.

EXISTING SURFACES

- A. Cut and patch existing surfaces for the installation of new or relocated equipment, doors,

partitions, etc., in a manner to minimize cracks and joints, to achieve a stable and structurally sound installation, and to make patched surfaces match and blend in with existing adjacent surfaces as nearly as possible.

- B. Prior to cutting which affects structural safety, submit written request to School District's Representative for permission to proceed.

NEW MATERIALS FOR PATCHING

- A. Furnish and install, wherever applicable, same type as existing studs, plaster, drywall, paneling, tile, or other finishes, or cut and modify and reinstall existing removed materials as required for a complete and satisfactory job.
- B. Furnish all necessary barricades.

LOCATION AND QUANTITY

- A. Refer to drawing and/or School District's Representative for all cutting and patching work required.
- B. Drilling through concrete or masonry floors or, walls must be by core drilling only, except where there is a danger of damage by water. Type of drilling for each hole shall be determined in conference with the School District's Representative.
- C. Cutting through walls or floors for the purpose of removal of portions, therefore, must be done by saw cutting only, except where there is a danger of damage bywater.
- D. Install required protection including but not limited to barricades, shoring, bracing, and supports to maintain the structural integrity of the work, and protection of personnel.

QUALITY ASSURANCE

Include within Contractor's quality assurance program such procedures as required to assure full protection of work and materials.

PROTECTION:

- A. Protect finished surfaces including jambs and soffits of openings used as passageways through which equipment and materials are handled.
- B. Provide protection for finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved over such surfaces.
- C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the School District.

REPAIRS AND REPLACEMENTS:

- A. In the event of damage, promptly make replacements and repairs at no additional cost to

the School District.

- B. Should it become necessary, due to and caused by, the work of the service Contractor, to enlist the services of an emergency mitigation Contractor specializing in flood, water, smoke or fire restoration, renovation and/or mold mitigation, the service Contractor will only utilize, at their sole expense, a company on the list of USD 500 approved vendors offering such services.

INSURANCE:

- C. Upon receipt of award, Contractor shall provide Certificate of Insurance as required within three (3) days after notification issued by the Purchasing Department.
- D. The following general insurance requirements apply to any and all work under this contract by all Contractors and subcontractors of any tier.
- E. Any and all insurance required by this contract with each and any and all insurance required by this contract shall be maintained during the entire length of this contract, including any extensions thereto, and until all work has been completed to the satisfaction of the KCKPS. Any and all insurance must be on an occurrence basis.
- F. No Contractor or subcontractor shall commence work under a contract until all insurance requirements contained within the solicitation have been complied with and until evidence of all insurance requirements in each and every contract with each and every subcontractor of any tier and shall require the same to comply with all such requirements.
- G. The KCKPS shall be covered as an Additional Insured under any and all insurance required by this contract. Confirmation of this shall appear on all certificates of insurance and on any and all applicable policies. The title of the awarded contract shall also appear on any and all applicable policies.
- H. The KCKPS shall be given no less than thirty (30) days' written notice of cancellation. The KCKPS shall be given not less than thirty (30) days' prior written notice of material changes of any insurance required under this contract. The KCKPS shall be given written notice of renewal of coverage not less than thirty (30) days prior to the expiration of any particular policy.
- I. Each and every agent shall warrant when signing the certificate of insurance that he/she is acting as an authorized representative on behalf of the companies affording insurance coverage under the contract and that he is licensed by the State of Kansas to conduct insurance business in the State of Kansas and that the companies affording insurance coverage are currently licensed by the State of Kansas and are currently in good standing with the Commissioner of Insurance for the State of Kansas.
- J. (6) Any and all companies providing insurance required by this contract shall meet the minimum financial security requirements as set forth below. The rating for each company must be indicated on the certificate of insurance.
- K. For all contracts, regardless of risk, companies providing insurance under this contract must have a current:
 - (a) Best's Rating not less than A, and
 - (b) Best's Financial Size Category not less than Class VII

- L. In the event the Contractor neglects, refuses, or fails to provide insurance required by the contract documents, or if such insurance is canceled for any reason, KCKPS shall have the right, but not the duty, to procure the same, and the cost thereof shall be deducted from monies then due or thereafter to become due to the Contractor or KCKPS shall have the right to cancel the contract.

M. Worker's Compensation and Employer's Liability Insurance

N. The Contractor shall procure and maintain Worker's Compensation and Employer's Liability Insurance in the following limits. Such insurance is to cover each and every employee who is or may be engaged in work under this contract.

O. Worker's Compensation Statutory

P. Employer's Liability

Bodily Injury by Accident.....\$1,000,000 each accident

Q. Bodily Injury by Disease.....\$1,000,000 each employee

R. Bodily Injury by Disease.....\$1,000,000 policy limit

X. Comprehensive General Liability Insurance

The Contractor shall procure and maintain Comprehensive Insurance in an amount not less than \$1,000,000 for bodily injury and property damage combined single limit. The following specific extensions of coverage shall be provided and indicated on the certificate of insurance:

- AA. (1) Comprehensive Form
- BB. (2) Contractual Insurance
- CC. (3) Personal Injury
- DD. (4) Broad Form Property Damage
- EE. (5) Premises – Operations
- FF. (6) Completed Operations

GG. This coverage shall cover the use of all equipment, hoists, and vehicles on the site(s) not covered by Automobile Liability under this contract. Policy coverage must be on an occurrence basis.

HH. Automobile Liability Insurance

II. The Contractor shall procure and maintain Automobile Liability Insurance in an amount not less than \$1,000,000 for bodily injury and property damage combined single limit. The following extensions of coverage shall be provided and indicated on the certificate of insurance.

- JJ. (1) Comprehensive Form
- KK. (2) Owned, Hired, Leased and non-owned vehicles

MM. If the Contractor does not own any vehicles in the corporate name, non-owned vehicles coverage shall apply and must be endorsed on either the Contractor's personal automobile policy or the Comprehensive General Liability coverage required under this contract.

NN. Commercial Crime insurance (when applicable)

OO. The Contractor shall procure and maintain Commercial Crime/Fidelity insurance in an amount not less than \$1,000,000.00, including coverage for theft or loss of KCKPS property.

A. FORM OF AGREEMENT & PAYMENT

The form of Agreement for work under this program shall be on a purchase order for work performed upon submittal of service invoices to KCKPS Facilities Department for approval. All payments will be in check form.

B. OWNER'S RIGHT TO TERMINATE FOR CAUSE

The Owner, KCKPS, reserves the right to terminate service agreement upon ten (10) days written notice, and Contractor fails to cure during the notice period, for the following reasons:

1. Failure of Contractor to adhere to hourly rates as bid.
2. Contractor's failure to timely respond to service requests.
3. Contractor's failure to comply with any part of these specifications.
4. Inferior work performed to KCKPS property, as reasonably determined by KCKPS.
5. Evidence of collusion, price fixing, or theft of KCKPS provided materials.
6. Failure to provide proof of insurance as required.

C. NORMAL SERVICE HOURS

Normal hours are considered eight (8) working hours from the commencement of work. In many instances class schedules, presence of students, school hours or other circumstances will require work to start at hours other than 7:00 a.m. to 3:30 p.m.

D. INTERPRETATION

Questions concerning technical **Electrical Services Main Replacement** specifications should be directed:

Brian Hernandez, Assistant Director of Purchasing

Brian.hernandez@kckps.org

Subject Line of email = "Questions – Electrical Services Main Replacement"

E. NO COMMITMENT; NON-EXCLUSIVITY

The Agreement will not authorize Contractor to provide or commit District to order any Deliverables or Services. Execution of a valid Purchase Order is District's agreement to pay for Deliverables or Services and Contractor's agreement to provide the Deliverables or Services, in each case in accordance with this Agreement and the applicable Purchase Order. District and Contractor acknowledge and agree that the appointment of Contractor hereunder is not exclusive. At any time, and in its sole discretion, District may perform any services similar to those to be provided by Contractor under this Agreement or any Purchase Order or may engage any third party to perform any services or provided any products similar to those to be provided by Contractor under this Agreement or any Purchase Order.

F. GOVERNING CONTRACTUAL PROVISIONS

The Provisions found in Contractual Provisions Attachment (Form DA-146a, Rev. 06-12), which is attached hereto, are hereby incorporated in this contract and made a part thereof.

G. Scope of Work

The Kansas City Kansas Public School District seeks qualified bids to for the Electrical Service Equipment Replacement at Eisenhower Middle School, located at 2901 N. 72nd St, Kansas City Kansas 66109.

Scope

The District desires to replace the existing main service, from a new transformer to be placed by BPU and associated switchgear, per attached plans provided by PKMR. All work from the new transformer to the building and interior switchgear will be coordinated with the setting of a new transformer by BPU.

Schedule

All work must be completed over the summer, 2020 between the dates of June 1 and July 31, 2020. Other construction activities will be occurring at the site over the same time period, so time is of the essence. The exact work schedule will be finalized between the District and winning bidder.

Bidders will provide and estimated schedule and timeline with their proposal.

BIDDER QUALIFICATIONS

TO BE EXECUTED BY AUTHORIZED OFFEROR AND SUBMITTED WITH OFFER

The bidder must include sufficient evidence to document the firm's capability to perform, such as the experience and qualifications pertinent to the requirements of this BID.

Qualification Requirements:
Vendor acknowledgement that purchase will be contingent upon KCKPS Board of Education Approval, successful completion of the KCKPS contracting procedures, and funding approval.
Vendor guarantee that all ELECTRICAL Installation is completed in compliance with applicable Kansas City, Kansas and Unified Government of Wyandotte County construction and building codes.
Vendor agrees to provide all permits, easements, and rights of use within the scope and cost of the proposal submitted.

SUBMITTAL INFORMATION

General Information: All responses shall conform to instructions provided in this Request for Proposal.

Deadline for BID Submittal: Proposers must submit all required documents prior to the deadline. All qualifications and proposals shall be complete and final with no additional information required after the close of the submittal date, unless specifically requested by the District. Responses received after the deadline will be returned unopened as not meeting the BID requirements.

Proposer Qualifications: Any individual firm submitting qualifications and a proposal must be able to provide evidence that the individual or firm and its personnel carrying out the responsibilities have expertise and experiences in all areas identified in this BID.

Supplementary Materials: Proposals should be accompanied by brochures and product cut sheets providing technical specifications for all services and systems described in this BID. If the literature differs in any manner from the systems and equipment being proposed, the differences must be fully clarified and explained.

References: Before awarding any contract, the District reserves the right to require Proposers to submit additional evidence of qualifications, as it may deem appropriate. This evidence may be concerning financial, technical, and other qualifications as well as relevant experience and skills of the Proposer.

QUALIFICATIONS AND PROPOSAL FORMAT: Proposers responding to this BID must follow the format below:

Submitted printed materials must be in bound 8.5" x 11" format.

Qualifications and proposals should be organized by section in the following manner and limited to the following number of pages for each section.

All references to page number requirements are single sided.

The District reserves the right to reject the proposal of any OFFEROR who previously failed to perform properly and efficiently. Each OFFEROR will be evaluated on past and present performance.

A. The OFFEROR's place of business:

Company Name: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Contact: _____

B. Current Business License Type and Number _____

C. Please list three (3) references that can verify the OFFEROR has rendered successful and efficient LIGHTING installations, and has successfully completed three (3) similar projects.

	Company Name	Address	Phone No.	Contact Person
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____

Explain your organization's prior experience (like or similar installation): _____

Please identify if your company has any pending litigation within the last five years: _____

The undersigned OFFEROR certifies that he or she is, at the time of offer, and shall be throughout the period of the contract, licensed by the State of Kansas to do the type of work required under the terms of the contract documents. OFFEROR further certifies that he or she is skilled and regularly engaged in the general class and type of work called for in the contract documents.

The OFFEROR represents that he or she is competent, knowledgeable and has special skills with respect to the nature, extent and inherent conditions of the work to be performed. OFFEROR further acknowledges that there are not certain peculiar and inherent conditions existent in the construction of the work, which may create, during the work, unusual or peculiar unsafe conditions hazardous to persons and property.

Furthermore, OFFEROR hereby certifies to the District that all representations, certifications and statements made

OFFEROR, as set forth in the proposal form, are true and correct and are made under penalty of perjury.

Signed this _____ day of _____, 2020.

Name of Offeror: _____

Authorized Signature: _____

Company Name: _____

Electrical Service Main Replacement

BID FORM

Electrical Upgrade Services	
Pricing	
Labor	\$
Materials/Installation	\$
Total Cost	\$
Days to Complete Project	Days

WE HEREBY AGREE TO FURNISH THE ITEMS ON WHICH PRICES ARE QUOTED ABOVE IN ACCORDANCE WITH ALL TERMS AND CONDITIONS PREVIOUSLY LISTED AND ANY ATTACHED SPECIFICATIONS.

BY: _____ DATE _____
TITLE: _____ FIRM: _____
PHONE: _____ EMAIL: _____

Send your completed bid to:

**Kansas City Kansas Public Schools
Purchasing Office – Attn: Assistant Director of Purchasing
2010 N. 59th Street, Room 370 Kansas City, Kansas 66104-2800**

**DIVISION 26
TABLE OF CONTENTS**

SECTION 260010 – ELECTRICAL PROVISIONS
SECTION 260011 – BASIC ELECTRICAL MATERIALS AND METHODS
SECTION 260013 – PROJECT COORDINATION
SECTION 260505 – ELECTRICAL DEMOLITION
SECTION 260519 – WIRE AND CABLE
SECTION 260526 – GROUNDING
SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
SECTION 260533 – RACEWAYS AND BOXES
SECTION 260553 – ELECTRICAL IDENTIFICATION
SECTION 262413 – DISTRIBUTION SWITCHBOARD

SECTION 260010 – ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Electrical Contractor, all sub-contractors, and all material suppliers.

1.2. SCOPE OF WORK

- A. This DIVISION requires the furnishing and installing of complete functioning Electrical systems, and each element thereof, as specified or indicated on Drawings or reasonably inferred, including every article, device or accessory reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include materials, labor, supervision, supplies, equipment, transportation, and utilities.
- B. Refer to Architectural, Structural and Mechanical Drawings and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams and other structural members to facilitate concealing conduit in the manner anticipated in the design.

1.3. SPECIFICATION FORM AND DEFINITIONS

- A. The Engineer indicated in these specifications is Pearson Kent McKinley Raaf Engineers LLC. 13300 W 98th Street, Lenexa, KS 66215, PHONE 913-492-2400, EMAIL admin@pkmreng.com.
- B. Contractor, wherever used in these specifications, shall mean the Company that enters into contract with the Owner to perform this section of work.
- C. When a word, such as "proper", "satisfactory", "equivalent", and "as directed", is used, it requires the Architect-Engineer's review.
- D. "PROVIDE" means to supply, purchase, transport, place, erect, connect, test, and turn over to Owner, complete and ready for regular operation, the particular Work referred to.
- E. "INSTALL" means to join, unite, fasten, link, attach, set up, or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular Work referred to.
- F. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application for the particular Work referred to.
- G. "WIRING" means the inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such Work.
- H. "CONDUIT" means the inclusion of all fittings, hangers, supports, sleeves, etc.
- I. "AS DIRECTED" means as directed by the Architect/Engineer, or his representative.
- J. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed above hung ceilings.

1.4. QUALIFICATIONS

- A. The contractors responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years. The contractors shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to insure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractors shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications upon request before any final approval and selection. Failure to be able to comply with these requirements is suitable reason for rejection of a bid.

1.5. LOCAL CONDITIONS

- A. The contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.6. CONTRACT CHANGES

- A. Changes or deviations from the contract documents; including those for extra or additional work must be submitted in writing for review of Architect-Engineer. No verbal change orders will be recognized.

1.7. LOCATIONS AND INTERFERENCES

- A. Locations of equipment, conduit and other electrical work are indicated diagrammatically by electrical drawings. Layout work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturers shop drawings.
- B. Study and become familiar with contract drawings of other trades and in particular general construction drawings and details in order to obtain necessary information for figuring installation. Cooperate with other workmen and install work in such a way to avoid interference with their Work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Architect-Engineer.
- C. Any conduit, apparatus, appliance or other electrical item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected without extra cost. Damage to other Work caused by this contractor, subcontractor, workers or any cause whatsoever, shall be restored as specified for new work.
- D. Do not scale electrical drawings for dimensions. Accurately layout work from dimensions indicated on Architectural drawings unless they are found to be in error.

1.8. PERFORMANCE

- A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.
- B. The Contractor warrants to the Owner and Architect-Engineer the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.

1.9. WARRANTY

- A. The Contractor warrants to the Owner and Architect-Engineer that upon notice from them within a one year warranty period following date of acceptance, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense.
- B. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.10. ALTERNATES

- A. Refer to General Requirements for descriptions of any alternates that may be included.

1.11. MATERIALS, EQUIPMENT AND SUBSTITUTIONS

- A. The intent of these specifications is to allow ample opportunity for the Contractor to use their ingenuity and abilities to perform the work to their and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
- B. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.
- C. In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.
- D. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.
- E. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.
- F. If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.

1. In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in mechanical or electrical service requirements necessary to accommodate such substitution.
 - G. Within 10 working days after bids are received, the apparent low bidder shall submit to the Architect-Engineer for approval, three copies of a list of all major items of equipment they intend to provide. Within 30 working days after award of Contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work, for Architect-Engineer review. Where 30-day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.
- 1.12. ELECTRONIC PLAN FILES
- A. Electronic files of the contract documents may be available from the Engineer to successful bidders and manufacturers for a fee of \$50 per sheet, \$100 minimum and \$25 email/shipping charge. A release of liability form will be required along with payment prior to release of files.
- 1.13. OPENINGS, ACCESS PANELS AND SLEEVES
- A. This Contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all conduits passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.
 - B. All penetrations through interior or exterior and rated or non-rated walls and floors shall be appropriately sealed prevent entry and movement of rodents and insects. Contractor shall coordinate their work with all other trades.
- 1.14. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS
- A. Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.
- 1.15. EXTENT OF CONTRACT WORK
- A. Provide electrical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of electrical systems. In no case will claims for "Extra Work" be allowed for work about which Electrical Contractor could have been informed before bids were taken.
 - B. Where specific information for devices, lights or equipment shown on the plans is missing, provide an allowance in the contract amount for furnishing a product reasonably implied by the level of other devices, lights and equipment provided in the contract documents.
 - C. Electrical Contractor shall be familiar with equipment provided by other Contractors that require electrical connections and control. Follow circuiting shown on drawings for lighting, power and equipment connections.
 - D. Make required electrical connections to equipment provided under Architectural and Mechanical divisions of this project. Receive and install electric control devices requiring field installation, wiring, and service connection. Equipment supplied by the automatic temperature control contractor shall be installed by the mechanical or automatic temperature control subcontractor. Make required internal field wiring modifications indicated on wiring diagrams of factory installed control systems for control sequence specified. These field modifications shall be limited to jumper connections and connection of internal wiring to alternate terminal block lugs. The cost for field modifications requiring rewiring of factory installed control systems for equipment provided by General or Mechanical Contractors shall be included in base bid of the respective contractor. All temperature control wiring shall be by a licensed electrician under the supervision of temperature control contractor.
 - E. Check electrical data and wiring diagrams received from Mechanical Contractor of compliance with project voltages, wiring, controls and protective devices shown on electrical drawings. Promptly bring discrepancies found to attention of Architect-Engineer for a decision.
 - F. Provide safety disconnect switches, contactors, and manual and magnetic motor starters for mechanical and electrical equipment requiring such devices. Omit these devices where included as part of factory installed prewired control systems provided with mechanical equipment. With exception of factory installed devices, provide safety disconnect switches, contacts and motor starters by one manufacturer to allow maximum interchangeability of repair parts and accessories for these devices.

- G. To maximum extent possible electrical controls in boiler rooms, equipment rooms, and control rooms shall be grouped in accessible locations and arranged according to function. Where possible use group control panels and combination starters in lieu of individually enclosed devices.

1.16. CODES, ORDINANCES, RULES AND REGULATIONS

- A. Provide work in accordance with applicable rules, codes, ordinances and regulations of Local, State, Federal Governments, and other authorities having lawful jurisdiction.
- B. Conform to latest editions and supplements of following codes, standards or recommended practices.
- C. BUILDING CODES:
 - 1. International Building Codes (Latest adopted version of applicable codes)
- D. SAFETY CODES:
 - 1. National Electrical Safety Code Handbook H30 - National Bureau of Standards
 - 2. Occupational Safety and Health Standard (OSHA) Department of Labor
- E. NATIONAL FIRE CODES AND STANDARDS:
 - 1. NFPA No. 70 National Electrical Code
 - 2. NFPA No. 90A Air Conditioning & Ventilation Systems
 - 3. NFPA No. 101 Life Safety Code
- F. UNDERWRITERS LABORATORIES INC.:
 - 1. All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.
- G. MISCELLANEOUS CODES:
 - 1. ANSI A117.1 - Handicapped Accessibility
 - 2. Americans with Disabilities Act (ADA)
- H. ENERGY EFFICIENCY REQUIREMENTS:
 - 1. All electrical systems and components shall be manufactured and installed in compliance with ASHRAE 90.1 – 2007 and latest adopted version of IECC.

1.17. STANDARDS

- A. Drawings and specifications indicate minimum construction standard, should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect/Engineer in writing before proceeding with work so that necessary changes can be made. However, if Electrical Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

1.18. PERMITS/FEEES

- A. Electrical Contractor shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submit two copies to Architect/Engineer with request for final review.
- B. Contractor shall include in bid any charges by local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exact which part of the work is to be performed bywhom.

PART 2 - PRODUCTS

- A. Not Used

PART 3 - EXECUTION

3.1. SUBMITTALS

- A. Contractor shall furnish submittals of all materials and equipment required by the specifications. Refer to each specification section for the submittals (if any) required for that section.
- B. Submittal format shall be as indicated below. Submittals not meeting these requirements will be returned without action for re-submittal.
 - 1. Submittals shall be furnished in an Adobe PDF format.
 - 2. Submittals shall be per individual submittal section, as listed in the table of contents. All required

submittals within that section shall be grouped together in a single submittal.

- a. Furnishing submittals by division or by individual item may result in delayed reviewing of the submittal(s) due to additional administrative time required to process the large size and/or quantity of files.
 3. Submittals shall have a cover page containing the following information: The project name, the applicable specification section and paragraph, the submittal date, and the Contractor's stamp (see below for requirements).
 4. Mark each submitted item as applicable with scheduled mark, name, etc. corresponding to the plans.
 5. Where generic catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fitting sizes, etc. that are to be provided. Each catalog sheet shall bear the equipment manufacturer's name and address.
 6. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization.
 7. All submittals on materials and equipment listed by UL shall indicate UL approval on submittal.
- C. Contractor review:
1. Contractor shall check all submittals to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All submittals submitted to Architect-Engineer shall bear contractor's approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return and drainage connections to building systems. All submittals not meeting Contractor's approval shall be returned to their supplier for re-submittal.
 2. No submittals will be considered for review by the Architect-Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor's review.
 3. Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.
- D. Review Schedule:
1. The shop drawing / submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus a duplication of this time for re-submittal if required.
 2. Submittal of all shop drawings as soon as possible after permitting approval but before construction starts is preferred.
 3. Approval of shop drawings submitted prior to receipt of a permit for that respective scope of work should be considered conditional pending review/approval of the construction documents by the AHJ. Changes required to the submittal as a result of permitting comments received after architect's/engineer's review shall not be a justification for a change in price.
 4. Any time delay caused by correcting and re-submitting submittals/shop drawings will be the Contractor's responsibility.
- E. The Architect's-Engineer's checking and subsequent review of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.
- F. Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.
- G. Submittals that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.
- H. Coordination
1. After shop drawings have been reviewed and approved by all parties, transmit a set of submittals to each other trade (eg Plumbing, Mechanical, Electrical, Controls, etc) that will interface with installation.

Each other contractor shall review the submittal for coordination and return a stamped submittal indicating they have reviewed the submittal for coordination purposes.

3.2. SHOP DRAWINGS

- A. Shop drawings shall meet all of the above requirements for submittals.
- B. Contractor shall submit Adobe PDF sets of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.
- C. No work shall be fabricated until Architect-Engineer's review has been obtained.
- D. Electrical equipment location and conduit coordination shop drawings for conduit fabrication and electrical equipment clearances shall be a minimum of 1/4" scale. Shop drawings shall not be a reproduction of the contract document and shall show details of the following: Fabrication, assembly, and installation, including plans, elevations above finished floor, sections, components, and attachments to other work.

3.3. OPERATING AND MAINTENANCE INSTRUCTIONS (O & M MANUALS)

- A. Submit with shop drawings of equipment, three sets of operating and maintenance instructions and parts lists for all items of equipment provided. Instructions shall be prepared by equipment manufacturer.
- B. Keep in safe place, keys and wrenches furnished with equipment under this contract. Present to Owner and obtain receipt for same upon completion of project.
- C. Prepare a complete brochure, covering systems and equipment provided and installed under his contract. Submit brochures to Architect/Engineer for review before delivery to Owner. Contractor at his option may prepare this brochure or retain an individual to prepare it for him. Include cost of this service in bid. Brochures shall contain following:
 - 1. Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined under Section this specification.
 - 2. Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
 - 3. Record copy of all submittals indicating actual equipment installed indicating options, characteristics. Copies of submittals shall bear the stamps of all parties that reviewed submittals.
 - 4. Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of system.
 - 5. Record Set Drawings: The Contractor shall mark up a set of contract documents during construction noting all changes and deviations including change orders. These will be delivered to Architect at end of the project. After the originals are changed to reflect the blue line set, a copy shall be included in the brochure.
 - 6. Provide brochure bound in black vinyl three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:
 - a. Project name and address.
 - b. Section of work covered by brochure, i.e., Electrical.

3.4. RECORD DOCUMENTS

- A. During construction, keep an accurate record of all deviations between the work as shown on Drawings and that which is actually installed. Keep this record set of prints at the job site for review by the Architect/Engineer.
- B. Upon completion of the installation and acceptance by the owner, transfer all record drawing information to one neat and legible set of prints. Then deliver them to the Architect/Engineer for transmittal to the Owner.

3.5. PREMIUM TIME WORK

- A. The following Work shall be performed at night or weekend other than holiday weekends as directed and coordinated with the Owner.
 - 1. All tie-in, cut-over and modifications to the existing electrical system and other existing system requiring tie-ins or modifications shall be arranged and scheduled with the Owner to be done at a time as to maintain continuity of the service and not interfere with normal building operations.

3.6. CLEANING UP

- A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc., resulting from the installation of his work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean.
- B. Contractor shall clean up all fixtures and equipment at the completion of the project.

- C. All switchboards, panelboards, wireways, trench ducts, cabinets and enclosures shall be thoroughly vacuumed clean prior to energizing equipment and at the completion of the project. Equipment shall be opened for observation by the Architect/Engineer as required.

3.7. WATERPROOFING

- A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect/Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
- B. If Contractor penetrates any walls or surfaces after they have been waterproofed, he shall restore the waterproof integrity of that surface as directed by the Architect/Engineer at his own expense

3.8. CUTTING AND PATCHING

- A. Contractor shall do cutting and patching of building materials required for installation of work herein specified. Remove walls, ceilings and floors (or portions thereof) necessary to accomplish scope of work. Do not cut or drill through structural members including wall, floors, roofs, and supporting structure, without the Architect's and Structural Engineer's approval and in a manner approved by them.
- B. Make openings in concrete with concrete hole saw or concrete drill. Use of star drill or air hammer for this work will not be permitted.
- C. Patching shall be by the contractors of the particular trade involved, shall match the existing construction type, quality, finish and texture, and shall meet approval of Architect-Engineer. Damage to building finishes, caused by installation of electrical work shall be repaired at Contractor's expense to approval of Architect-Engineer.

3.9. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

- A. Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown or specified. Level, shim, and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instruction. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.
- B. Floor or pad mounted equipment shall not be held in place solely by its own dead weight. Include anchor fastening in all cases.
- C. Provide electrical floor mounted equipment with 3-1/2" high concrete bases unless shown or specified otherwise. Electrical contractor shall size all pads. General contractor shall form all pads, provide and place all concrete for said pads. Individual concrete pad shall be no less than 4" wider and 4" longer than equipment, and shall extend no less than 2" from each side of equipment.
- D. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform or carrier in accordance with best recognized practice. Electrical contractor shall arrange for attachment to building structure, unless otherwise indicated on drawings or as specified. Provide hangers with vibration eliminators where required. Contractor shall verify that structural members of building are adequate to support equipment. Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect/Engineer for review before proceeding with fabrication or installation.
- E. Provide 3-1/2" high concrete housekeeping pad as specified above where two or more conduits penetrate floor below panelboards.

3.10. START-UP, CHANGEOVER, TRAINING AND OPERATION CHECK

- A. Electrical Contractor shall be responsible for training Owner's operating personnel to operate and maintain systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructor's name, names of Owner's personnel attending and total hours of instruction given each individual.
- B. All owner-training sessions shall be orderly and well organized and shall be video recorded digitally. At the end of the owner training, the "training" session recording shall be transmitted to the owner via DVD and shall become property of the owner.

3.11. FINAL CONSTRUCTION REVIEW

- A. At final construction review, Electrical Contractor and the major sub-contractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by Architect/Engineer, that the work complies with purpose and intent of plans and specifications. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

END OF SECTION 260010

SECTION 260011 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Reference Section 260010.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1. NEUTRAL AND GROUND WIRES

- A. Where individual circuit homeruns (hots, neutral, and ground as part of a single circuit) are indicated on the plans serving lighting and branch circuit receptacle loads, these shall be individual circuits with individual neutrals (no sharing of neutrals and/or grounds).
- B. Where shared circuit homeruns (hots, neutral, and ground as part of separate circuits) are indicated on the plans, these shall be allowed to share one (common) ground for three (3) circuits from different phases occurring in one (1) conduit run. When additional circuits occur in conduit run, additional ground wires shall be installed. Conduit shall be upsized and conductors shall be de-rated based on NEC current carrying conductor tables, counting all hots and neutrals as current carrying conductors.
 1. No sharing of neutral conductors is allowed in multi-wire branch circuit homeruns, unless the installation meets the requirements of 2014 NEC 210.4(B), and is specifically approved by the engineer of record.

3.2. TESTS RECORDING, REPORTING TESTS AND DATA

- A. Record nameplate horsepower, amperes, volts, phase service factor and other necessary data on motors and other electrical equipment furnished and/or connected under this contract.
- B. Record motor starter catalog number, size and rating and/or catalog number of thermal-overload units installed in all motor starters furnished and/or connected under this contract. See motor starter specification for instructions for proper sizing of thermal-overload units.
- C. Record amperes-per-phase at normal or near-normal loading of each item of equipment furnished and/or connected.
- D. Record correct readings of each feeder conductor after energized and normally loaded, and again after balancing of feeder loads as required by current readings.
- E. Record voltage and ampere-per-phase readings taken at service entrance equipment after completion of project with building operating at normal electrical load.
- F. Short-Circuit Calculations
 1. Contractor shall contact utility company after utility company design is complete and determine exact available fault current in amperes at the point of utility connection (Service Point).
 2. Contractor shall utilize the above available fault current to calculate the available fault current in amperes (RMS-SYM) at the service equipment.
 3. The available fault current shall be labeled on the service equipment – refer to Section 260553.
- G. Submit at least two (2) typewritten copies of data noted above to Architect-Engineer for review prior to final inspection.
- H. Keep a record of all deviations made from routes, locations, circuiting, etc. shown on contract drawings. Prior to final inspection submit one new set of project drawings with all deviations and changes clearly indicated.

3.3. CLEANING AND PAINTING OF MATERIALS AND EQUIPMENT

- A. Before energizing switchboards, transformers, panelboards, starters, variable frequency drive and other similar electrical equipment, Contractor shall thoroughly vacuum out all dirt, dust and debris from inside of equipment and shall thoroughly clean outside and inside of equipment.
- B. Touch-up painting and refinishing of factory applied finishes shall be by Electrical Contractor. Contractor shall be responsible for obtaining proper type of painting materials and color from equipment manufacturer.
- C. Unless specified otherwise factory built equipment shall be factory painted. Paint shall be applied over surfaces only after they have been properly cleaned and coated with a corrosion resistant primer.
- D. After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to

factory materials. Finish coating shall be same color and type as factory finish.

- E. Where extensive refinishing is required equipment shall be completely repainted.

3.4. EXCAVATION AND BACKFILL

- A. Perform necessary excavation to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. for this operation, and remove at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.
- B. Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.
- C. Conduct excavations so no walls or footings are disturbed or injured.
- D. Backfill excavations made under or adjacent to footing with selected earth or sand and tamp to compaction required by A/E.
- E. Mechanically tamp backfill under concrete and pavings in 6" layers to 95% standard density, Reference Division 2.
- F. Backfill trenches and excavations to required heights with allowance made for settlement.
- G. Tamp fill material thoroughly and moistened as required for specified compaction density.
- H. Dispose of excess earth, rubble and debris as directed by Architect.
- I. When available, refer to test hole information on architectural drawings or specifications for types of soil to be encountered in excavations.

3.5. FIRE BARRIERS

- A. Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around piping with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.
- B. Equivalent by Dow, Chemelex, 3M.
- C. All holes or voids created by the electrical contractor to extend conduit or wiring through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall have ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheetforms.

3.6. TEMPORARY COVERINGS

- A. Provide temporary covering over all electrical panels, distribution panelboards, outlet boxes and other equipment as required to keep same free from damage due to moisture, plaster, paint, concrete or other foreign materials. Any equipment with finish damaged by moisture, paint, plaster or other foreign materials shall be cleaned and refinished as directed by the Architect without additional cost to the Owner.
- B. All temporary openings in conduits shall be covered with metal or plastic caps.

3.7. PROTECTIVE COVERS

- A. Provide protective wire guards over all wall mounted and ceiling mounted devices subject to damage in areas such as gymnasiums, shops and similar occupancies.
- B. Provide lockable covers over thermostats and similar wall mounted devices where items are located in public spaces but should not be operable by the general public.

3.8. SLEEVES

- A. Provide proper type and size sleeves to General Contractor for electrical ducts, busses, conduits, etc. passing through building construction. Supervise installation to insure proper sleeve location. Unless indicated or approved install no sleeves in structural members.
- B. Provide cast iron sleeves extending 1 inch above finished floor where sleeves pass through floors subject to flooding such as toilet rooms, bathrooms, equipment rooms and kitchen. Seal opening between pipe and sleeve with Thunderline Corp. Link Seal.
- C. Unless specified otherwise provide 18 gauge galvanized sheet metal sleeves through floors and non-bearing walls. Where piping passes through exterior walls, equipment room walls, air plenum walls and walls between areas that must be isolated from occupied areas, seal space between sleeves and piping, air or water tight are required with Thunderline Corp. Link Seal.
- D. Provide O-Z Electrical Manufacturing Co., Inc. Type "FSK" or "WSK" or equivalent thruwall and floor seals where conduits pass through concrete foundation walls below grade.
- E. Provide Zurn Z-195 or equivalent flashing sleeve through walls and floors with waterproof membrane. Seal annular space between conduit and sleeve with Thunderline Link Seal or O-Z type CSM sealingbushing.

END OF SECTION 260011

SECTION 260013 – PROJECT COORDINATION

PART 1 GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
 - 4. Requests for Interpretation (RFIs).
 - 5. Wiring of equipment furnished by others
- B. Each related sub-contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.3. COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Delivery and processing of submittals.
 - 2. Progress meetings.
 - 3. Preinstallation conferences.
 - 4. Project closeout activities.
 - 5. Startup and adjustment of systems.

1.4. SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
 - 1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.

Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches. Format shall be PDF or other electronic format to facilitate multiple user commenting and sharing easily.
 3. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including project managers, superintendent and other personnel in attendance at Project site to the General Contractor and other major subcontractors. Identify individuals and their duties and responsibilities; list email addresses and telephone numbers. Update the list as required during the project if personnel change.

1.5. COORDINATION

- A. Certain materials will be provided by other trades. Examine the Contract Documents and reviewed record Submittals to ascertain these general requirements. Contract Documents reflect a basis of design and may not reflect actual equipment or items being utilized.
 - B. Carefully check space requirements with other trades and the physical confines of the area to insure that all material can be installed in the spaces allotted thereto including finished suspended ceilings and the spaces within the existing building. Make modifications thereto as required and approved.
 - C. Transmit to other trades all information required for work to be provided under their respective Sections in ample time for installation.
 - D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.
 - E. Obtain equipment submittal information for all pieces of equipment to be connected to from other trades that clearly indicates all connection requirements, locations, sizes, and similar requirements. Obtain this information in ample time to coordinate other trade submittals and equipment coordination. Where requirements differ from that on plans or differs from provisions made in the work, immediately notify the Architect/Engineer. Do not proceed with work that is incompatible with equipment provided.
 - F. Coordinate, project and schedule work with other trades in accordance with the construction sequence.
 - G. Coordinate with the local Utility Companies to their requirements for service connections and provide all necessary materials, labor and testing.
 - H. Coordinate with contractors for work under other Divisions of this specification for all work necessary to accomplish this contractor's work.
 - I. Conduct a coordination meeting after reviewing all other trade coordination drawings with other relevant trades. This meeting shall be held to prevent conflicts during construction. Each major relevant subcontractor shall attend this meeting. Report any potential conflicts or clearance problems to Architect/Engineer after meeting.
 - J. Adjust location of piping, ductwork, conduit, wiring, etc. to prevent interferences, both anticipated and encountered. Determine the exact route and location of each item prior to fabrication.
1. Right-of-Way:
 - a. Lines that pitch have the right-of-way over those that do not pitch. For example: steam, condensate, and plumbing drains normally have right-of way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
 - b. Make offsets, transitions and changes in direction in raceways as required to maintain proper headroom in pitch of sloping lines whether or not indicated on the Drawings.

1.6. DRAWINGS AND FILES.

- A. The Drawings show only the general run of MEP systems, equipment, fixtures, piping and ductwork and other components as well as approximate location of items such as outlets, switches, diffusers, lights, and equipment connections, etc. Coordinate all exact locations of items with other trades, architectural elevations, equipment requirements, owner requirements, ceilings, access, serviceability, etc. All such modifications and coordination shall be made without additional cost to the Owner. Any significant changes in location of items necessary in order to meet field conditions shall be brought to the immediate attention of the Architect/Engineer and receive his approval before such alterations are made
- B. Wherever the work is of sufficient complexity, additional Detail Drawings to scale similar to that of the bidding Drawings, prepared on tracing medium of the same size as Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the

area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field. Attend meetings with other trades to review all documents.

- C. When directed by the General Contractor for areas of necessary coordination provide 3D building modelling coordination files and documents with other trades. Transmit information electronically and attend meetings as directed by the G/C as well as take part in coordination activities and documentation. Contractor shall be required to generate their own electronic files for this process.

1.7. PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. The Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Possible conflicts.
 - i. Compatibility problems.
 - j. Time schedules.
 - k. Manufacturer's written recommendations.
 - l. Warranty requirements.
 - m. Compatibility of materials.
 - n. Space and access limitations.
 - o. Regulations of authorities having jurisdiction.
 - p. Testing and inspecting requirements.
 - q. Installation procedures.
 - r. Coordination with other work.
 - s. Required performance results.
 - t. Protection of adjacent work.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- C. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other

items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

- a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contractor is on time, ahead or behind schedule, in relation to Construction Schedule. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time. Discuss impact of various contractor schedules upon other contractors and how to remedy impacts.
 - b. Review present and future needs of each contractor present, including the following:
 - i. Interface requirements.
 - ii. Sequence of operations.
 - iii. Status of submittals.
 - iv. Deliveries.
 - v. Off-site fabrication.
 - vi. Access.
 - vii. Quality and work standards.
 - viii. Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8. REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI.
 1. Submit Contractor's suggested solution(s) to RFI. If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 2. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

3.1. EQUIPMENT FURNISHED BY OTHERS

- A. Description:
 1. Items furnished by other trades (mechanical or plumbing contractor, etc.) such as mechanical/plumbing equipment, line voltage actuators, VFDs (not by electrical contractor), etc.
 2. Equipment furnished by general contractor
 3. Equipment furnished by owner
- B. General
 1. Fully review manufacturer's installation instructions for equipment. Installation of all related electrical items noted below shall be per same.
 - a. Electrical contractor shall obtain same from others if not readily available.
- C. Disconnecting Means
 1. An approved disconnecting means shall be provided at all equipment and shall serve to disconnect power from same.
 2. Disconnecting means may be a switch, circuit breaker, or a cord-and-plug type connection.
 3. Disconnecting means shall be within sight of equipment, as defined by NEC.
 4. Disconnect switches may be non-fused, unless specifically shown fused on the plans or otherwise required by code to be fused.
 - a. All disconnect switches serving elevator equipment shall be provided with an overcurrent protective device.
- D. Wiring of Equipment
 1. Wire sizes used shall be as directed on plans or installation instructions, whichever is greater. Contractor shall notify engineer of any deviations from wire sizes listed on construction documents.
 2. Wiring shall include a neutral conductor where shown on plans or required by installation instructions.

- a. If a neutral conductor is shown on the plans but not required by installation instructions, verify removal of neutral wire with engineer via RFI prior to proceeding.
- 3. Wiring of elevators and other such equipment shall account for voltage drop limitations of equipment.
- 4. Wiring of VFDs shall be as follows:
 - a. Secondary VFD cables shall be symmetrically shielded and grounded or, where the length of the conductors is less than the VFD manufacturer's recommended maximum, be copper conductors installed in metallic conduit. Same shall not be installed in the same raceway as other cables or combined in wire gutters or cable trays

END OF SECTION 260013

SECTION 260505 – ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Reference Section 260010.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SCOPE

- A. Demolition work to be performed whether shown or not on the drawings. Disconnect and remove any lights, equipment, conduit, wiring, devices, etc. not required to remain and/or required to be removed to accommodate new construction.

1.3. SUMMARY

- A. This Section requires the selective removal and subsequent offsite disposal of the following:
 - a. Mechanical and electrical equipment, devices, piping, conduits, ductwork, insulation, lighting, etc in existing building as required to accommodate new construction.
 - b. Removal of MEP items in interior partitions.
 - c. Removal and protection of existing fixtures, materials, and equipment items to be removed, salvaged, relocated, reinstalled, etc.

1.4. SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Schedule indicating proposed sequence of operations for selective demolition work to Architect for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
 - 1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
 - 2. Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed remodeled areas.
- C. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Architect prior to start of work.

1.5. JOB CONDITIONS

- A. Occupancy: Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in such a manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.
- B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of Contractor's inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
- C. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed. Storage or sale of removed items on site will not be permitted.
- D. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.
 - a. Provide protective measures as necessary and required to provide free and safe passage of Owner's personnel and general public to any occupied portions of building.
 - b. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
 - c. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
 - d. Construct temporary insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.

- e. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
 - f. Remove protections at completion of work.
2. Damages: Promptly repair damages caused to adjacent facilities by demolition work.
3. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- E. Flame Cutting:
- 1. Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.
- F. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
- 1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
- G. Maintain fire protection services during selective demolition operations.
- H. Environmental Controls:
- a. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing and/or approved regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1. PREPARATION

- A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
- B. Cease operations and notify Architect immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
- C. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to any occupied portions of the building.
 - a. Where selective demolition occurs immediately adjacent to any occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation as required by Architect.
 - b. Provide weatherproof closures for exterior openings resulting from demolition work.
- D. Locate, identify, stub off, and disconnect utility services that are not indicated to remain. Provide bypass connections as necessary to maintain continuity of service to any occupied areas of building. Provide minimum of 72 hours advance notice to Architect if shutdown of service is necessary during changeover.

3.2. DEMOLITION

- A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
 - 1. Demolish concrete and masonry in small sections. 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.
 - 2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
 - 3. Provide services for effective air and water pollution controls as required.
 - 4. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of

approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter.

- B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to architect in written accurate detail. Pending receipt of directive from Architect, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3. SALVAGED MATERIALS

- A. Salvaged Items: Where indicated on Drawings as "Salvage - Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain a receipt.

3.4. DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove debris, rubbish, and other materials resulting from demolition operations from building site. Transport and legally dispose off site.
- B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
- C. Burning of removed materials is not permitted on Project site.

3.5. CLEANUP AND REPAIR

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 260505

SECTION 260519 – WIRE AND CABLE

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.

1.3. SUBMITTALS

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

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.

PART 2 - PRODUCTS

2.1. CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Southwire Company.
 - 2. General Cable Corporation.
 - 3. Encore Wire Corporation.
 - 4. AFC Cable Systems, Inc. (Multiconductor cable only)
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Aluminum Conductors: Comply with NEMA WC 70.
- D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN-2.
 - 1. Provide consistent color coding of all circuits as follows:

Phase	Distribution System	
	120/208	277/480
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
N	White	Gray
Ground	Green	Green w/ Stripe ¹

Notes:

- 1) Stripe shall be white or yellow in color.
- 2) "Isolated Power System" as referenced by NEC 517.160 for anesthetizing locations.

- E. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2. CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cable manufacturers listed above under 2.1, Item A.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1. CONDUCTOR MATERIAL APPLICATIONS

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

3.2. CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Provide insulation / cable types for conductors as follows:

Application	Insulation / Cable Type		
	THHN/THWN-2 ¹	XHHW-2 ¹	MC Cable ³
Service Entrance	X ²	X	
Feeders:			
Exposed, Exterior	X ²	X	
Exposed, Interior	X		
Concealed in Ceilings, Walls, Partitions, and Crawlspace	X		
Concealed in Concrete, below Slabs-on-Grade, and Underground	X ²	X	
Branch Circuits:			
Exposed, Exterior	X ²	X	
Exposed, Interior - Including Crawlspace	X		
Concealed in Ceilings, Walls, and Partitions	X		X
Concealed in Concrete, below Slabs-on-Grade, and Underground	X ²	X	
Isolated Power Systems		X	

Notes:

- 1) Single conductors in raceway. Refer to Section 260533 - Raceway & Boxes for acceptable raceway types/applications.
- 2) THHN/THWN-2 is acceptable for these installations at contractor's discretion.
- 3) Metal Clad (MC) cable installations shall be in accordance with the following:
 - (i) MC cable shall not be used for homeruns.
 - (ii) MC cable may be used for light fixture and equipment whips in lengths no longer than 6'-0". The use of MC cable from lighting fixture to lighting fixture shall not be allowed.
 - (iii) MC cable shall not be installed in exposed locations for lighting purposes. MC cable may be exposed in mechanical spaces for equipment whips.
- B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- C. Class 1 Control Circuits: Type THHN-THWN-2, in raceway.
- D. Class 2 Control Circuits: Type THHN-THWN-2, in raceway or Power-limited cable, concealed in building finishes.

3.3. INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not

Deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables per National Electrical Code requirements.
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4. CONNECTIONS

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

3.5. 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 service entrance and feeder conductors for compliance with requirements.
 - 2. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 – GROUNDING

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Reference Section 260010.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

- A. Provide grounding electrodes, conductors, connections and equipment to provide a solidly grounded electrical system.

1.3. STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
 - 1. Underwriters Laboratory Standard No. U.L. 467.
 - 2. ANSI C-1 1978.
 - 3. IEEE Standards No. 142-1982, 1100-1992 and No. 80.
 - 4. National Electrical Safety Code.
 - 5. NFPA.

1.4. SUBMITTALS

- A. Submit test reports certifying resistance values for buried or driven grounds and waterpipe grounds.

PART 2 - PRODUCTS

2.1. MATERIALS

- A. Ground Cables: green color coded, insulated, annealed stranded tinned copper wire as indicated on Drawings; insulated wire to conform with requirements of Section 16120.
- B. Mechanical Connectors: Tin-plated aluminum alloy, UL approved and stamped for use with aluminum or copper conductors.
- C. Ground Rods:
 - 1. Copper-clad steel fabricated by molten welding process.
 - 2. Diameter: 5/8 Inch. Use 3/4" for rocky soil.
 - 3. Length: 8 feet.
- D. Ground Lugs and Connectors for Cable Tray: Tin-plated aluminum alloy suitable for use with aluminum or copper conductors.

2.2. GENERAL

- A. Grounding systems shall be installed in accordance with the requirements of the local authorities, and subject to the approval of the Architect/Engineer.
- B. All ground wires and bonding jumpers shall be stranded copper installed in conduit. All ground wires shall be without joints and splices over its entire length.
- C. The system neutral shall be grounded at the service entrance only, and kept isolated for grounding systems throughout the building.
- D. Each system of continuous metallic piping and ductwork shall be grounded in accordance with the requirements of the National Electrical Code.
- E. Mechanical equipment shall be bonded to the building equipment grounding system. This shall include but is not limited to, fans, pumps, chillers, etc.
- F. PVC conduits and portions of metallic piping and duct systems which are isolated by flexible connections, insulated couplings, etc., shall be bonded to the equipment ground with a flexible bonding jumper, or separate grounding conductor.
- G. Metal raceways, cable trays, cable armor, cable sheath, enclosures, frames, fittings and other metal noncurrent-carrying parts that are to serve as grounding conductors shall be effectively bonded where necessary to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed on them. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces or be connected by means of fittings so designed as to make such removal unnecessary.

2.3. SEPARATELY DERIVED SYSTEMS

- A. Equipment grounding conductors shall be provided for separately derived systems and shall be grounded to building steel, cold water pipes, etc., or an alternate grounding means.

2.4. RECEPTACLES

- A. Receptacles shall be grounded to the outlet box by means of a bonding jumper between the outlet box and the receptacle grounding terminal.

2.5. ISOLATED GROUND RECEPTACLES

- A. Isolated ground receptacles ground lug shall not be connected to the respective outlet boxes.
- B. Provide insulated ground wire for each isolated ground receptacle. Ground wire shall serve only those receptacles which are isolated. Route ground conductor together with phase and neutral conductors in a common raceway.
- C. Terminate isolated ground wire at the ground from the separately derived system serving the receptacles. Where not supplied by a transformer, run the isolated ground wire to the service ground bus.

2.6. CONCENTRIC KNOCKOUTS

- A. Provide grounding type bushings for conduits terminated through multiple concentric knockouts not fully knocked out, on inside of electrical enclosures. Install bonding jumper between ground bushing and enclosure

2.7. RAISED FLOORS

- A. Provide bonding of all raised floors.
- B. Provide insulated #4 ground from opposite ends of raised floor to panelboard serving that area.

2.8. TOGGLE SWITCHES

- A. Provide grounding clip on each toggle switch. Mount over device mounting strap such that contact is made between mounting strap, screw, and faceplate and outlet box.
- B. Provide devices with ground screw and bond to switch box.

2.9. GROUNDING METHODS

- A. The metal frame of the building, where effectively grounded.
- B. A metal underground water piping system used for grounding shall be in direct contact with the earth for ten feet or more and shall be electrically continuous. Provide bonding jumpers at water meter and at insulated joints.
- C. Steel reinforcing bars used for grounding shall be encased by at least two inches of concrete, located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth. Reinforcing bars shall be minimum 1/2 inch diameter and consisting of twenty feet of one or more steel reinforcing bars.
- D. All bonding jumpers for the above grounding systems shall be sized in accordance with National Electrical Code.

PART 3 - EXECUTION

3.1. INSTALLATION

- A. Cold Water Pipe Grounding:
 - 1. Make connection with clamp type fitting; do not damage water pipe.
 - 2. Bond ground conductor and its conduit to water pipe.
 - 3. Install No. 4/0 AWG bonding jumper with ground clamps around water meter.
- B. Ground Conductors:
 - 1. Size as shown on Drawings or as required by National Electrical Code. Grounding conductors shall be as shown on plans or if not specifically shown shall be no smaller than that required by the NEC.
 - 2. Where ground cables are required, install insulated copper ground conductors in steel conduit, or as indicated.
 - 3. Where ground cable is installed in metallic conduit, bond cable to conduit at both ends.
 - 4. Connect ground conductors in cables and in conduit to appropriate ground buses (as in switchgear, motor control centers, and distribution panelboards) or directly to metallic enclosure if no ground bus is provided.
- C. Service Ground

1. Connect system neutral ground and equipment ground system to common ground bus.
2. Ground secondary services at supply side of each individual secondary disconnecting means and at related transformers in accordance with National Electric Code.
3. Provide each service disconnect enclosure with neutral disconnecting means which interconnects with insulated neutral and uninsulated equipment ground sub to establish system common ground point.
4. Neutral disconnecting links shall be located so that low voltage neutral bar with interior secondary neutrals can be isolated from common ground bus and service entrance conductors.

D. Conduit Attachment to Electrical Equipment:

1. Ground conduits to metal framework of electrical equipment with double locknuts or grounding bushings and bonding jumpers unless otherwise noted.
2. Install bonding jumpers' at all electrical equipment to provide continuous ground return path through conduit.
3. Install bonding jumpers across expansion fittings between conduit sections for ground path continuity.
4. Bond conduits to cable tray where conduit enters or exits tray.
5. Equipment grounding conductors for branch circuit home runs shown on the drawings shall indicate an individual and separate ground conductor for that branch circuit which shall be terminated at the branch circuit panelboard, switchboard, or other distribution equipment. No sharing of equipment grounding conductors sized according to the size of the overcurrent device and NEC Table 250-122 shall be allowed.
6. Required equipment grounding conductors and straps shall be sized in compliance with N.E.C. Table 250-122.
7. Equipment grounding conductors shall be provided with green type TW 600 volt insulation. Related feeder and branch circuit grounding conductors shall be connected to ground bus with approved pressure connectors.
8. Provide feeder servicing several panelboards with a continuous grounding conductor connected to each related panelboard ground bus. Installation shall include necessary precautions regarding terminations with dissimilar metals.

E. Circuiting

1. Provide low voltage distribution system with a separate green insulated equipment grounding conductor for each single or three-phase feeder.
2. Single phase 120 volt branch circuits for lighting and power shall consist of phase and neutral conductors and a green ground conductor installed in common metallic conduit which shall serve as grounding conductor.
3. Provide flexible metallic conduit utilized in conjunction with above single phase branch circuits with suitable green insulated grounding conductors connected to approved grounding terminals at each end of flexible conduit.
4. Single phase branch circuit installed in nonmetallic conduits shall be provided with separate grounding conductor.
5. Install grounding conductor in common conduit with related phase and/or neutral conductors.
6. Where parallel feeders are installed in more than one raceway, each raceway shall have a green insulated equipment grounding conductor.

F. Receptacles and Switches:

1. Install bonding jumpers between outlet box and receptacle grounding terminal except where contact device or yoke is provided for grounding purposes.

G. Wireways:

1. Install grounding jumpers for bonding between wireway and other panelboards, conduit, switchgear, motor control centers, and at any other point where solid connection would otherwise not provided in supporting system to insure continuous ground.

H. Pull Boxes, Junction Boxes and Enclosures:

1. Connect all equipment grounding conductors together and connect to the box.

3.2. FIELD QUALITY CONTROL

A. Resistance Values for System and Equipment Grounds: for each ground rod and groundgrid.

1. Acceptable Testing Equipment: Vibroground by Associated Research, Inc.; or Megger Earth Tester by

- James G. Biddle Co.
2. Method: Three (3) electrode fall of potential as prescribed by instrument manufacturer.
 3. Drive additional ground rods spaced eight feet apart, if necessary, until total resistance of system is measured at five ohms or less.

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.
- B. Related Sections include the following:
 - 1. Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

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.

1.5. QUALITY ASSURANCE

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

1.6. 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. These items are specified in Division 07 Section "Roof Accessories."

PART 2 PRODUCTS

2.1. SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.

- B. 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.
- 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.
- 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - i. Hilti Inc.
 - ii. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - iii. MKT Fastening, LLC.
 - iv. Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - i. Cooper B-Line, Inc.; a division of Cooper Industries.
 - ii. Empire Tool and Manufacturing Co., Inc.
 - iii. Hilti Inc.
 - iv. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - v. MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2. FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

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. Support raceways at intervals no greater than ten (10) feet and with one support within three (3) feet of each coupling, box, fitting, or outlet box. Provide one support within three (3) feet of each elbow or bend.
- C. 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.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 20 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and

smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2. SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. 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:
 - a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts
 - b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
 - c. Spring-tension clamps].
 - 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.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3. INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4. CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 260529

SECTION 260533 – RACEWAYS AND BOXES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Reference Section 260010.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

- A. Provide complete raceways systems, boxes and fittings for all required electrical systems.

1.3. STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:

- 1. Rigid Steel Conduit
 - a. U.L. Standard UL-6
 - b. A.N.S.I. C80-1
 - c. Federal Specification WW-C-581E
- 2. Intermediate Metallic Conduit
 - a. U.L. Standard UL-1242
 - b. Federal Specification WW-C-581E
- 3. Electrical Metallic Tubing
 - a. U.L. Standard UL-797
 - b. A.N.S.I. C80-3
 - c. Federal Specification WW-C-563
- 4. Flexible Steel Conduit
 - a. U.L. Standard UL-1
- 5. Liquid Tight Flexible Conduit
 - a. U.L. Standard UL-360
- 6. Non-Metallic Conduit
 - a. U.L. Standard UL-651
 - b. A.N.S.I. Standard F512
 - c. N.E.M.A. Standard TC-2
 - d. Federal Specifications GSA-FSS and W-C-1094-A
- 7. Wireways and Auxiliary Gutters
 - a. U.L. Standard UL-870
- 8. Rigid Aluminum Conduit
 - a. A.N.S.I. C80.5

1.4. SUBMITTALS

- A. Provide manufacturer's catalog cuts of fittings.
- B. Where wireways and/or auxiliary gutters are employed full erection drawings must be submitted. Drawings to include plan views, elevations, size of wireways, type and quantity of conductors proposed to be installed therein, etc.
- C. Indicate duct banks or multi-trade coordinated shop drawings.
- D. Submit shop drawings or catalog descriptive data on boxes exceeding twenty-four (24") inches for any one dimension.
- E. Submit shop drawings or catalog descriptive for floor boxes and accessories.

PART 2 - PRODUCTS

2.1. RACEWAY TYPES

- A. Standard Threaded Rigid Steel Conduit.
 - 1. Rigid conduit heavy wall galvanized.
 - 2. Threaded type fittings: "Erickson" couplings where threaded cannot be used.
- B. Intermediate Metallic Conduit
 - 1. Light weight rigid steel conduit.
 - 2. Threaded type fittings: "Erickson" couplings where threaded cannot be used.
- C. Electrical Metallic Tubing
 - 1. Continuous, seamless tubing, galvanized or sheradized on the exterior, coated on the interior with a smooth hard finish of lacquer, varnish, or enamel.
 - 2. Couplings and connectors:
 - a. Indoor and two (2") inches in size and smaller, shall be steel set-screw type fittings.
 - b. 2-1/2 inch size and larger must employ steel compression gland fittings.
 - c. Outdoor shall be raintight steel compression gland fittings.
 - 3. Indent type fittings shall not be used.
 - 4. All connectors shall have insulated throat.
 - 5. Where installed in slab or concrete work, provide approved concrete tight fittings.
- D. Flexible Steel Conduit
 - 1. Single strip, continuous, flexible interlocked, double-wrapped steel, galvanized inside and outside, forming smooth internal wiring channel.
 - 2. Maximum length: (six 6) feet.
 - 3. Each section of raceway must contain an equipment grounding wire bonded at each end and sized as required. Provide connectors with insulating bushings.
 - 4. Steel squeeze-type or steel set screw type fittings.
- E. Liquid Tight Flexible Electrical Conduit
 - 1. Same as flexible steel conduit except with tough, insert water-tight plastic outer jacket.
 - 2. Cast malleable iron body and gland nut, cadmium plated with one-piece brass grounding bushings which thread to interior of conduit. Spiral molded vinyl sealing ring between gland nut and bushing and nylon insulated throat.
- F. Non-Metallic Raceway
 - 1. Composed of polyvinyl chloride suitable for 90 degrees C. Provide rigid polyvinyl chloride (PVC) type EPC 40 heavy wall plastic conduit meeting current NEMA Standard TC-2. Conduit shall be listed UL 651 for underground and exposed use.
 - 2. Raceway, fittings, and cement must be produced by the same manufacturer who must have had a minimum of ten (10) years experience in manufacturing the products.
 - 3. Materials must have a tensile strength of 7,000-7,200 psi at 73.4 degrees F., flexural strength of 12,000 psi and compressive strength of 9,000 psi.
 - 4. All joints shall be solvent cemented in accordance with the recommendations of the manufacturer.
- G. Wireways and Auxiliary Gutters
 - 1. Painted steel or galvanized steel.
 - 2. Of sizes and shapes indicated on the Drawings and as required.
 - 3. Provide all necessary elbows, tees, connectors, adapters, etc.
 - 4. Wire retainers not less than twelve (12") inches on center.
- H. Aluminum Conduit
 - 1. Do not use aluminum conduit unless specifically indicated on the drawings for special purposes.

2.2. LOCKNUTS AND BUSHINGS

- A. Locknuts shall be steel. Die cast locknuts shall not be used.
- B. All bushings shall be insulated. Use nylon insulated metallic bushings for sizes 1" and larger. Plastic bushings

may be used in 1/2" and 3/4" sizes.

2.3. OUTLET, JUNCTION, AND PULL BOXES

A. Cast Type Conduit Boxes, Outlet Bodies and Fittings

1. Provide surface mounted outlet and junction boxes, in indoor locations, where exposed to moisture and in outdoor locations.
2. Use Ferrous Alloy boxes and conduit bodies with Rigid Steel or IMC.
3. Use Ferrous Alloy or cast aluminum boxes and conduit bodies with Electrical Metallic Tubing.
4. Covers: Cast or sheet metal unless otherwise required.
5. Tapered threads for hubs.

B. Galvanized Pressed Steel Outlet Boxes

1. General
 - a. Pressed steel, galvanized or cadmium-plated, minimum of four (4") inches, octagonal or square, with galvanized cover or extension ring as required.
2. Concrete Box
 - a. Four (4") inch octagon with a removable backplate and 3/8" fixture stud, if required. Depth of box shall allow for a minimum of one (1") inch of concrete to be poured above the backplate.
3. Switch and Receptacle Box, Indoors
 - a. Nominal four (4") inches square, 1-1/2" or 2-1/2" deep as required, with raised cover unless otherwise indicated on drawings. Gangable boxes shall not be used.
4. Data/Telephone outlet box, Indoors
 - a. Nominal four (4") inches square, 2-1/2" deep, with raised cover unless otherwise indicated on drawings. Gangable boxes shall not be used.
5. Lighting Fixture Box
 - a. Four (4") inch octagon with 3/8" fixture stud.
 - b. For suspended ceiling work, four (4") inch octagon with removable backplate where required, and two (2) parallel bars for securing to the cross-furring channels and extend flexible conduit to each fixture.
6. Plug any open knockouts not utilized.

C. Sheet Steel Boxes Indoors

1. No. 12 USS gauge sheet steel for boxes with maximum side less than forty (40") inches, and maximum area not exceeding 1,000 square inches; riveted or welded 3/4 inch flanges at exterior corners.
2. No. 10 USS gauge sheet steel for boxes with maximum side forty (40") to sixty (60") inches, and maximum area 1,000 to 1,500 square inches; riveted or welded 3/4 inch flanges at exterior corners.
3. No. 10 USS gauge sheet steel riveted or welded to 1-1/2 by 1-1/2 by 1/4" welded angle iron framework for boxes with a maximum side exceeding sixty (60") inches and more than 1,500 square inches in area.
4. Covers
 - a. Same gauge steel as box.
 - b. Subdivided single covers so no section of cover exceeds fifty (50) pounds.
 - c. Machine bolts, machine screws threaded into tapped holes, or sheet metal screws as required; maximum spacing twelve (12") inches.
5. Paint
 - a. Rust inhibiting primer; ANSI No. 61 light gray finish coat.
6. Where size of box is not indicated, size to permit pulling, racking and splicing of cables.
7. For Boxes over 600 Volts
 - a. Provide insulated cable supports and removable steel barriers to isolate each feeder. Stencil cable voltage class in red letters on the front cover of the box.
 - b. Braze a ground connector suitable for copper cables to the inside of the box.

D. Pull and Splice Boxes, Outdoors

1. Aluminum reinforced, with removable covers secured by brass machine screws.
2. Where size of box is not indicated, size to permit pulling, racking, and splicing of the cables.
3. Braze a ground connector suitable for copper cables to the inside of the box.

PART 3 - EXECUTION

3.1. APPLICATION OF RACEWAYS

- A. The following applications must be adhered to except as otherwise required by Code. Raceways not conforming to this listing must be removed by this Contractor and replaced with the specified material at this Contractors expense.
1. Rigid Steel - Application: Where exposed to mechanical injury, where specifically required, exterior exposed locations, and where required by codes and for all circuits in excess of 600 volts.
 2. I.M.C. - Application: Same as standard threaded rigid steel conduit.
 3. E.M.T. - Applications: Use in every instance except where another material is specified. EMT shall not be used underground or in slab on grade.
 4. Flexible Steel - Applications: Use in dry areas for connections to lighting fixtures in hung ceilings, connections to equipment installed in removable panels of hung ceilings at bus duct takeoffs, at all transformer or equipment raceway connections where sound and vibration isolation is required.
 5. Liquid-Tight Flexible Conduit - Applications: Use in areas subject to moisture where flexible steel is unacceptable at connections to all motors, and all raised floor areas.
 6. Non-Metallic Conduit - Application: Schedule 40 - Where specifically indicated on the drawings and for raceways in slab or below grade. All bends shall be made with steel elbows and wrapped unless the bend is encased in concrete.
 7. Wireways and Auxiliary Gutters - Application: Where indicated on the Drawings and as otherwise specifically approved.

3.2. RACEWAY SYSTEMS IN GENERAL

- A. Provide raceways for all wiring systems, including security, data transmission, paging, low voltage et. al. Where non-metallic raceways are utilized, provide sizes as required with the grounding conductor considered as an insulated additional conductor. Wiring of each type and system must be kept independent and installed in separate raceways – including, but not limited to:
1. Wiring of different voltages (480/277V vs. 208/120V)
 2. Emergency / Normal Wiring (except as permitted by NEC 700)
- B. Install capped bushings on raceways as soon as installed and remove only when wires are pulled. Securely tie embedded raceway in place prior to embedment. Lay out the work in advance to avoid excessive concentrations of multiple raceway runs.
- C. Locate raceways so that the strength of structural members is unaffected and they do not conflict with the services of other trades. Install one (1") inch or larger raceways, in or through structural members (beams, slabs, etc.) only when and in the manner accepted by the Architect/Engineer. Draw up couplings and fittings full and tight.
- D. Install no conduits or other raceways sized smaller than permitted in applicable NEC Tables. Where conduit sizes shown on drawings are smaller than permitted by code, Contractor shall include cost for proper size conduit in his base bid. In no case reduce conduit sizes indicated on drawings or specified without written approval of Architect-Engineer. Minimum conduit size shall be 3/4".
- E. Above-grade raceways to comply with the following:
1. Install raceways concealed except at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Install a minimum of six (6") inches from flues, steam pipes, or other heated lines. Provide flashing and counter-flashing for waterproofing of raceways, outlets, fittings, etc., which penetrate the roof. Route exposed raceways parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Run concealed raceways in a direct line and, where possible, with long sweep bends and offsets. Provide sleeves in forms for new concrete walls, floor slabs, and partitions for passage of raceways. Waterproof sleeved raceways where required.
 2. Raceways shall not be run on roofs or exposed on the outside of the buildings unless specifically noted as exposed on the drawings or approved by the Architect/Engineer.
 3. Provide raceway expansion joints for exposed and concealed raceways with necessary bonding conductor at building expansion joints and between buildings or structures and where required to compensate for raceway or building thermal expansion and contraction. Provide expansion fittings

4. every 200 feet on outdoor conduit.
 4. Provide one (1) empty 3/4 inch raceway for each three (3) spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduit in a junction box, which after completion, is accessible to facilitate future branch circuit extension.
 5. Provide raceway installation (with appropriate seal-offs, explosion-proof fittings, etc.) in special occupancy area, as required. Provide conduit seal-offs where portions of an interior raceway system pass through walls, ceiling, or floors which separate adjacent rooms having substantially different maintained temperatures, as in refrigeration or cold storage rooms.
 6. Provide pull string in spare or empty raceways. Allow five (5) feet of slack at each end and in each pull box. Tie each end of the string to a washer or equivalent that does not fit into the conduit. Tag both ends of string denoting opposite end termination location.
- F. Below Grade
1. Below grade raceways to comply to the following:
 - a. Do not penetrate waterproof membranes unless proper seal is provided.
 2. Protect steel raceway in earth or fill with two (2) coats of asphalt base paint. Touch up abrasions and wrench marks after conduit is in place.
 3. In lieu of the above, protect steel raceways with a minimum of ten (10) mil tape approved for the purpose and overlapped a minimum of one-half tape width to provide a minimum twenty (20) mil thickness.
- G. No raceway may be installed in a concrete slab or members except with the permission of the Structural Engineer and with the written consent of the Owner.
1. Conduits embedded in structural concrete slabs shall have an outside diameter less than one third of the thickness of the concrete slab and shall be installed entirely within the center one third of the concrete slab.
 2. Raceways embedded in concrete slabs shall be spaced not less than eight (8") inches on centers and as widely spaced as possible where they converge at panels or junction boxes.
 3. In no case will installation of raceways be permitted to interfere with the proper placement of principal reinforcement.
 4. Raceways running parallel to slab supports, such as beams, columns, and structural walls, shall be installed not less than twelve (12") inches from such supporting elements.
 5. To prevent displacement during concrete pour of lift slab, saddle supports for conduit, outlet boxes, junction boxes, inserts, etc., shall be secured with suitable adhesives.
- H. Non-metallic raceway installation shall conform to the following:
1. All joints are to be made by the solvent cementing method using the material recommended by the raceway manufacturer. To insure good joints, components shall be cleaned prior to assembly.
 2. Raceway cut-offs shall be square and made by handsaw or other approved means which does not deform the conduit. Raceway shall be reamed prior to solvent cementing to couplings, adapters, or fittings.
 3. Electrical devices which are served by PVC raceways shall be grounded by means of a ground wire pulled in the raceway.
 4. Bends shall be made by methods that do not deform or damage the conduit. The radii of field bends shall not be less than those established by the N.E.C.
 5. Raceway expansion fittings shall be provided where necessary. The position of the expansion fitting shall be adjusted proportional to the temperature at installation.
 6. Raceway supports shall be installed, in such a manner, to allow the PVC conduit to slide through the supports as the temperature changes.
 7. Elbows must be galvanized rigid steel, intermediate metallic conduit or concrete encased. Plastic conduit may only be used for exterior underground applications or circuits beneath slabs on grade. Provide galvanized rigid steel (GRS) radius bends and risers as conduits rise above grade or above floor slab.
 8. Provide exterior underground conduit with metal detection strip.
 9. Provide matching plastic fittings. Fittings shall meet the same standards and specifications as the conduit on which it is installed.
 10. Joining and bending of conduit and installation of fittings shall be done only by methods recommended.
 11. Provide conduit support spacing as recommended for the highest ambient temperature expected.
 12. Provide interlocking conduit spacers for multiple runs of underground conduits installed in same trench.

13. Provide expansion couplings on long runs regardless of ambient temperatures. Determine amount of conduit expansion and contraction from published charts or tables.
 14. Test workmanship by conducting a low-pressure air (3.0-5.0 psi) test after system is installed and cemented joints are set. Plug and block ends to prevent movement prior to pressurization. Check for leaks at all joints with a soap solution. Even low-pressure air can cause high thrust loads and caution must be observed. The test shall be observed by the architect, engineer or owner's representative, prior to backfill. All below grade conduit that could potentially drain water into electrical equipment (ie. Main electrical service located in basement below utility transformer) must be watertight.
- I. Raceways in hung ceiling shall be run on and secured to slab or primary structural members of ceiling, not to lathing channels or T-bars, Z-bars, or other elements which are the direct supports of the ceiling panels. Secure conduit firmly to steel by clips and fittings designed for that purpose. Install as high as possible, but not less than 1'-0" above hung ceilings.
 - J. Exposed raceways shall be run parallel or at right angles with building lines.
 - K. Clear raceway of all obstructions and dirt prior to pulling in wires or cables. This shall be done with ball mandrel (diameter approximately 85% of conduit inside diameter) followed by close fitting wire brush and wad of felt, or similar material. This assembly may be pulled in together with, but ahead of, the cable being installed. All empty raceways shall be similarly cleaned. Clear any raceway which rejects ballmandrel.

3.3. OUTLET, JUNCTION, AND PULLBOXES

- A. Provide outlet, junction, and pullboxes as indicated on the drawings and as required for the complete installation of the various electrical systems, and to facilitate proper pulling of wires and cables.
 1. J-boxes and pullboxes shall be sized per electrical code minimum.
 2. Boxes on empty conduit systems shall be sized as if containing conductors of #4 AWG.
 3. Wiring systems required to have separate/independent raceways (See Section 3.2 above) shall also be provided with separate junction and pull boxes. These wiring systems may occupy the same outlet box only if a divider is installed between the wiring that is listed for this purpose.
- B. Install boxes and covers for wiring devices so that the wiring devices will be installed with a vertical orientation unless otherwise noted on the drawings.
- C. The exact location of outlets and equipment is governed by structural conditions and obstructions, or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment. Verify final location of outlets, panels equipment, etc., with Architect.
- D. Back-to-back outlets in the same wall, or "thru-wall" type boxes not permitted. Provide twelve (12") inch (minimum) spacing for outlets shown on opposite sides of a common wall to minimize sound transmission.
- E. Provide twenty four (24") inch (minimum) horizontal spacing for outlets shown on opposite sides of a fire rated wall and provide listed fire putty pads around the each box to maintain fire rating.
- F. Fit outlet boxes in finished ceilings or walls with appropriate covers, set flush with the finished surface. Where more than one switch or device is located at one point, use gang boxes and covers unless otherwise indicated. Sectional switch boxes or utility boxes will not be permitted. Provide Series "GW" (Steel City) tile box, or as accepted, or a four (4") inch square box with tile ring in masonry walls, which will not be plastered or furred. Where drywall material is utilized, provide plaster ring. Provide outlet boxes of the type and size suitable for the specific application. Where outlet boxes contain two (2) or more 277 volt devices, or where devices occur of different applied voltages, or where normal and emergency devices occur in same box, provide suitable barrier.
- G. Install top of switch outlet boxes 48" above floor unless otherwise called for or required by wainscot, counter, etc. Install bottom of receptacle outlet boxes 16" above floor unless otherwise called for on drawings. Adjust mounting heights to nearest masonry joint for minimum cutting in case of flush outlets.
- H. Install all wall mounted switch and receptacle boxes with bracing between two adjacent studs where rigid conduit is not used for circuiting. Box and receptacle shall not deflect on operation or insertion of plugs.
- I. Pull Box Spacing
 1. Provide pull boxes so no individual conduit run contains more than the equivalent of four (4) quarter bends (360 degrees total).
 2. Conduit Sizes 1-1/4" and Larger.
 - a. Provide boxes to prevent cable or wire from being excessively twisted, stretched, or flexed during installation.
 - b. Provide boxes for medium voltage cables so that maximum pulling tensions do not exceed cable manufacturer's recommendations.

- c. Provide support racks for boxes with multiple sets of conductors do not rest on any metal work inside box.
3. Conduit Sizes one (1") inch and smaller, low voltage wire and cable (maximum distances)
- a. 200 feet straight runs.
 - b. 150 feet runs with one 90 degree bend or equivalent.
 - c. 125 feet runs with two 90 degree bends or equivalent.
 - d. 100 feet runs with three or four 90 degree bends or equivalent.

END OF SECTION 260533

SECTION 260553 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Reference Section 260010.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

- A. A. Provide identification on all equipment, raceways, boxes and conductors.

PART 2 - PRODUCTS

2.1. NAMEPLATES

- A. Nameplates shall be lamacoid plates with engraved upper-case letters and beveled edges.
- B. Color:
 - 1. Normal-power equipment shall have white nameplates with black letters, enclosed by a black border.
 - 2. Equipment fed from the emergency electrical system, or otherwise designated on the plans for emergency use, shall have red nameplates with white letters, enclosed by a white border.
 - 3. Nameplates for short circuit ratings and calculations shall be yellow with black letters, enclosed by black border.
- C. All nameplates shall be engraved and must be secured with rivets, brass or cadmium plate screws. The use of Dymo tape or the like is unacceptable.
- D. Nameplate inscriptions shall bear the name and number of equipment to which they are attached as indicated on the Drawings. The engineer reserves the right to make modifications in the inscriptions as necessary.

2.2. CABLE TAGS AND WIRE IDENTIFICATION LABELS

- A. Cable tags shall be flameproof secured with nylon ties.
- B. Wire markers shall be preprinted cloth tape type or approved equivalent.

2.3. IDENTIFICATION LABELS

- A. Acceptable Manufacturers
 - 1. W.H. Brady Company (Style A)
 - 2. Thomas & Betts Company (T&B), Style A.
 - 3. Seaton
- B. Plasticized Cloth
 - 1. Non-conductive.
 - 2. Waterproof.
 - 3. Capable of withstanding continuous temperatures of 235 degrees F and intermittent temperatures to 300 degrees F.
 - 4. Overcoating for protection against oil, solvents, chemicals, moisture, abrasion and dirt.
- C. Heavy, thermo-resistant industrial grade adhesive, for adhesion of label to any surface without curling, peeling or falling off.
- D. Label Designations, Nominal System Voltages Applied to the covers of all medium and low voltage pull, splice and junction boxes.
- E. Machine printed.

PART 3 - EXECUTION

3.1. INSTALLATION

- A. Service Entrance Equipment
 - 1. Where electrical equipment (switchboard, panelboard, disconnect switch, etc.) is installed as service entrance equipment, contractor shall furnish and install a nameplate listing the following:

- a. Equipment Short-Circuit Current Rating in amperes (RMS SYM), as indicated on the drawings.
- b. Whether or not the equipment is fully or series-rated.
- c. Available Fault Current in amperes. Contractor shall perform available fault current calculation (as outlined in Section 260520) to obtain available fault at Service Equipment.
- d. Date fault current calculations were performed.
- i. Example:

EQUIPMENT FULLY-RATED AT 65,000 AMPERES RMS SYM AVAILABLE FAULT CURRENT: 61,603 AMPERES DATE CALCULATED: 12/06/2011

B. Switchboards/ Distribution Panelboards.

- 1. Furnish and install a nameplate for each switchboard or distribution panelboard. Nameplate shall be engraved with the following information:
 - a. Top Line: Equipment identification as indicated on the Drawings.
 - b. Middle Line: Specific device or equipment where feeder originates.
 - c. Bottom Line: Equipment voltage, size, and phase as indicated on the drawings.
 - d. Example:

SWITCHBOARD SWDP1 FED FROM UTILITY COMPANY TRANSFORMER 208/120V, 1200A, 3-PHASE

- 2. Nameplate shall be mounted at the top of the incoming section.
- 3. Each switch / circuit breaker shall be provided with an identifying nameplate.
 - a. Main devices shall be identified as such. Where multiple mains are employed each switch shall be numbered. Inscription shall be "MAIN SWITCH" or "MAIN SWITCH NO. 1" et al.
 - b. Branch/feeder devices shall be identified with either the load served or a number corresponding to the furnished circuit directory.

C. Panelboards and Load Centers.

- 1. Furnish and install a nameplate for each panelboard and load center. Nameplate shall be engraved with the following information:
 - a. Top Line: Equipment identification as indicated on the Drawings.
 - b. Middle Line: Specific device or equipment where feeder originates.
 - c. Bottom Line: Equipment voltage, size, and phase as indicated on the drawings.
 - d. Example:

PANELBOARD LN1 FED FROM SWITCHBOARD SWDP1 IN ROOM #332 208/120V, 200A, 3-PHASE
--

- 2. Nameplate shall be mounted at the top of the panel.
- 3. After installations are complete, provide and mount under sturdy transparent shield in the directory frame of each panel door, a neat, accurate, and carefully typed directory properly identifying the lighting, receptacles, outlets, and equipment each overcurrent device controls.
 - a. Include on directory the panel or load center identification, the cable and raceway size of panel feeder, and the feeder origination point.

D. Disconnect Switches.

- 1. Furnish and install a nameplate for each disconnect switch engraved with the equipment designation which the disconnect serves and the panel and circuit the switch is fed from.

E. Disconnect Switches.

- 1. Furnish and install a nameplate for each disconnect switch engraved with the equipment designation

which the disconnect serves.

a. Example:



2. Nameplate shall be mounted at the top of the disconnect.

F. Feeder Switches.

1. Furnish and install for each feeder switch including, but not limited to those in switchboards, switch and fuse panelboards, take-offs at bus ducts, motor control centers, multiple meter centers, etc., two (2) nameplates as follows:

a. The first nameplate must be white background with red lettering. Engrave with the words "REPLACE ONLY WITH _____ FUSE." Engrave with proper fuse trade name and ampere rating (i.e. Bussman LPS-R 100).

b. The second nameplate shall indicate the load served, the size and type of cable and raceway example:

i. LP-4, LP-5, LP-6

ii. 4#500 KCMILS-THW-CU-3-1/2"C

G. Switches.

1. Furnish and install an engraved nameplate for each switch, controlling loads that are not local to the switch. Engraving shall be as directed by the Engineer.

H. Pullboxes, Enclosures, and Cable Terminations.

1. Circuits rated over 40 Amp and all cables over 600V:

a. Provide identification label with circuit numbers on enclosure cover.

b. Furnish and install cable tags on each cable that enters a pullbox, enclosure, switchboard, and at terminations. Mark tags with type written inscription noting the load served, type and size of cable, and the overcurrent device protecting the cable.

I. Branch circuits:

1. Provide identification label with panel and circuit numbers on enclosure cover.

2. Identify each circuit with wire markers when enclosure label and wire colors do not provide enough information to identify each circuit without tracing.

3. Provide feeders and branch circuit home runs with plasticized wire marker indicating circuit number and power source. Provide feeders phase identification letter at each terminal point in addition to its circuit number.

4. 4 square box covers hidden above lay-in ceilings may be marked with indelible ink marker in lieu of using printed labels.

A. Generator Control Panel.

1. Furnish and install a red nameplate for each generator control panel. Engraving shall indicate the generator controlled by the panel.

B. Warning Signs

1. Provide electrical equipment and accessible wiring enclosures operating at voltage above 240 volts with self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1-1964 and OSHA 19.0.144iii(2) Specifications "Danger High Voltage" warning sign and voltage marker applied to front door or cover of device or enclosure.

2. Provide large equipment such as transformers and main distribution equipment with self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1-1964 and OSHA 19.0.144iii(2) Specifications indicating all electrical characteristics.

C. Boxes

1. Provide identification labels for all low voltage and medium voltage pull, splice and junction boxes in main feeder and subfeeder runs, indicating nominal system voltage.

2. Apply labels after painting of boxes, conduits, and surrounding areas have been completed.
3. Clean surfaces before applying labels; clean aluminum surfaces with solvent wipe.
4. Apply labels on cover and minimum of one (1) fixed side; one (1) label visible from floor where boxes are installed exposed.

END OF SECTION 260553

SECTION 262413 – DISTRIBUTION SWITCHBOARD

PART 1 - GENERAL

1.1. SCOPE

- A. The Contractor shall furnish and install, where indicated, a free-standing, dead-front type low voltage distribution switchboard, utilizing group mounted circuit protective devices as specified herein, and as shown on the contract drawings.

1.2. RELATED DOCUMENTS

- A. Reference Section 260010.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3. REFERENCES

- A. The low voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:
 - 1. NEMA PB-2
 - 2. UL Standard 891
 - 3. UL standard 1066
 - 4. UL standard 489
 - 5. UL Standard 1449 4th edition

1.4. SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each switchboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.
 - 3. Include schematic and wiring diagrams for power, signal, and control wiring.
- C. Field quality-control reports.
- D. Operation and maintenance data.

1.5. QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- D. Where noted in the contract documents provide seismic qualified equipment.

1.6. REGULATORY REQUIREMENTS

- A. The low-voltage switchboard shall be UL labeled.

1.7. DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.8. OPERATION AND MAINTENANCE MANUALS

- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

1.9. WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- A. Approved Manufacturers.
 1. Eaton
 2. Square D
 3. Siemens
- B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2. RATINGS

- A. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage or as shown on the contract documents.
- B. Bus voltage and current rating to be as indicated on the contract documents.

2.3. CONSTRUCTION

- A. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.
- B. All sections of the switchboard shall be front and rear aligned with depth as shown on the drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall.
- C. The assembly shall be provided with adequate lifting means.
- D. The switchboard shall be equal to Eaton type Pow-R-Line C utilizing the components herein specified and as shown on the drawings.
- E. The switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

2.4. BUS

- A. All bus bars shall be silver-plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria.
- B. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.
- C. A 1/4 x 2 inch copper ground bus (minimum) shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.
- D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.5. WIRING/TERMINATIONS

- A. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
- B. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as indicated on the drawings.
- C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.
- D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.6. MAIN AND FEEDER PROTECTIVE DEVICES - UL1066 - POWER CIRCUIT BREAKERS – (MAGNUMDS)

- A. All power circuit breakers shall be constructed and tested in accordance with ANSI C37.13, C37.16, C37.17, C37.50, UL 1066 and NEMA SG-3 standards. The circuit breakers shall carry a UL label.
- B. Power circuit breakers shall be low-voltage power circuit breakers, Eaton type Magnum DS or approved equal. All frame sizes shall have a common height and depth. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.
- C. Breakers shall be manually operated (MO).
- D. All circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings. To ensure a selective system, all circuit breakers shall have 30-cycle short-time withstand ratings equal to their symmetrical interrupting ratings through 85,000 amperes, regardless of whether equipped with instantaneous trip protection or not.
- E. Breakers shall include an anti-single-phase device.
- F. The primary contacts shall have an easily accessible wear indicator to indicate contact erosion.
- G. The power circuit breaker shall have three windows in the front cover to clearly indicate any electrical accessories that are mounted in the breaker. The accessory shall have a label that will indicate its function and voltage. The accessories shall be plug and lock type and UL listed for easy field installation. They shall be modular in design and shall be common to all frame sizes and ratings.
- H. The breaker control interface shall have color-coded visual indicators to indicate contact open or closed positions as well as mechanism charged and discharged positions. Manual control pushbuttons on the breaker face shall be provided for opening and closing the breaker. The power circuit breaker shall have a "Positive On" feature. The breaker flag will read "Closed" if the contacts are welded and the breaker is attempted to be tripped or opened.
 - 1. The breaker shall include padlockable pushbutton covers.
- I. The current sensors shall have a back cover window that will permit viewing the sensor rating on the back of the breaker. A rating plug will offer indication of the rating on the front of the trip unit.
- J. Each power circuit breaker shall offer sixty (60) front mounted dedicated secondary wiring points. Each wiring point shall have finger safe contacts, which will accommodate #10 AWG maximum field connections with ring tongue or spade terminals or bare wire.
- K. Microprocessor-based Trip Units
 - 1. Each power circuit breaker shall be equipped with a true RMS sensing, solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. Interchangeable current sensors with their associated rating plug shall establish the continuous trip rating of each circuit breaker.
 - 2. Trip units shall have an information system that provides LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the LED indication after an automatic trip.
 - 3. Trip units shall be provided with a display panel, including a representation of the time/current curve, that will indicate the protection functions.
 - 4. Trip units shall be continuously self-checking and provide a visual indication that the internal circuitry is being monitored and is fully operational.
 - 5. Trip units shall be provided with a making-current release circuit. The circuit shall be armed for approximately two cycles after breaker closing and shall operate for all peak fault levels above 25 times the ampere value of the rating plug.
 - 6. Trip units shall have selectable thermal memory for enhanced circuit protection.
 - 7. Trip units shall include the following individually adjustable time/current curve shaping solid-state elements:
 - a. Programmable long-time setting
 - b. Programmable long-time delay with selectable I^2t [and I^4t curve shaping – DT-1150+ only]
 - c. Programmable short-time setting
 - d. Programmable short-time delay with selectable flat or I^2t curve shaping
 - e. Programmable instantaneous setting including OFF position
 - f. Circuit breakers, where indicated on the drawings, shall have individually adjustable ground fault current pickup and time, with selectable flat or I^2t curve shaping. Provide ground fault trip or ground alarm only as shown on the drawings.
 - 8. Circuit breakers, where indicated on the drawings, shall include an Arc Flash Reduction Maintenance

System (ARMs)

- a. The ARMs technology shall be provided to reduce arc energy during periods of maintenance. The system shall engage an independent, reduced instantaneous pickup and reduce total clearing time when activated.
 - b. The pick-up value shall be adjustable with a minimum of (5) settings to allow the greatest arc energy reduction without nuisance tripping.
 - c. With the ARMs technology active, total clearing time shall not exceed 40 msec for any fault currents above the pick-up value.
 - d. Activation and deactivation of the ARMs technology and local indication shall be accessible from the face of the trip unit without opening the circuit breaker door and exposing operators to energized parts. Recalibration or adjustment of trip unit parameters shall not be required when enabling / disabling the ARMs technology.
 - i. Breakers shall include a local, lockable ARMs activation selector switch and pilot light indication.
 - e. Breakers shall include interposing relay to allow for remote ARMs activation from a remote contact closure and remote indication of ARMs status via an output relay.
9. Trip units shall provide zone selective interlocking (ZSI) for the short-time delay and ground fault delay trip functions for improved system protection and arc energy reduction. For faults within the protected zone, the zone interlocking system shall override programmed time delays to allow the upstream breaker to trip with minimal time delay.
- a. Factory shall wire for zone interlocking for the circuit breakers within the switchgear.
10. Cause-of-trip LED indications shall include battery backup to indicate mode of trip following an automatic trip operation. A test pushbutton shall energize an LED to indicate the battery status.
11. Trip units shall have provisions for a single test kit to test each of the trip functions.
12. Advanced Trip Unit Features [Digitrip 520MC]
- a. Trip units shall have a 4-character LCD display showing phase, neutral, and ground current. The accuracy of these readings shall be +/- 2% of full scale.
 - b. Trip units shall be equipped to permit communication via a network twisted pair to for remote monitoring. All monitored parameters and statuses shall be transmitted.
- L. Ground fault protection shall be provided where indicated.
- M. Where indicated provide 100% rated UL listed circuit breakers.
- 2.7. UL1066 – POWER CIRCUIT BREAKERS – SERIES NRX (800A MAX)
- A. All power circuit breakers shall be constructed and tested in accordance with ANSI C37.13, C37.16, C37.17, C37.50, UL 1066 and NEMA SG-3 standards. The circuit breakers shall carry a UL label.
 - B. Protective devices shall be low-voltage power circuit breakers, Eaton type Series NRX or approved equal. Frame ratings shall be 800 amps. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.
 - C. Breakers shall be manually operated (MO).
 - D. All circuit breakers shall have a minimum symmetrical interrupting capacity of *[42,000] [50,000] [65,000] amperes at 480V. To ensure a selective system, all circuit breakers shall have 30-cycle short-time withstand ratings equal to their symmetrical interrupting ratings through 42,000 amperes, regardless of whether equipped with instantaneous trip protection or not.
 - E. The power circuit breaker shall have a closing time of not more than 3 cycles. The primary contacts shall have an easily accessible wear indicator to indicate contact erosion.
 - F. The power circuit breaker shall have a nameplate clearly marking any electrical accessories that are mounted in the breaker at the time of sale. The accessory shall have a label that will indicate its function and voltage. All accessories shall be modular, plug and lock type, and UL listed for easy field installation.
 - G. The breaker control interface shall have color-coded visual indicators to indicate contact open or closed positions as well as mechanism charged and discharged positions. Manual control pushbuttons on the breaker face shall be provided for opening and closing the breaker. The power circuit breaker shall have a "Positive On" feature. The breaker flag will read "Closed" if the contacts are welded and the breaker is attempted to be tripped or opened.
 - 1. The breaker shall include padlockable pushbutton covers.
 - H. The nominal current rating (In) can be changed by changing the rating plug only. A rating plug on the trip unit

- will offer indication of the rating on the front of the trip unit. No current sensor change-outs are necessary.
- I. Each power circuit breaker shall offer a maximum of fifty-four (54) front mounted dedicated secondary wiring points, with the option to be individually populated. Each wiring point shall be a tension clamp type with finger safe contacts, which accommodates one - #12 AWG per connection point, with bare wire.
 - J. Microprocessor-Based Trip Units
 1. Each power circuit breaker shall be equipped with a true RMS sensing, solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. Interchangeable rating plugs shall establish the continuous trip rating of each circuit breaker.
 2. Trip units shall have an information system that provides LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the LED indication after an automatic trip.
 3. Trip units shall be provided with a display panel, including a representation of the time/current curve, that will indicate the protection functions.
 4. Trip units shall be continuously self-checking and provide a visual indication that the internal circuitry is being monitored and is fully operational.
 5. Trip units shall be provided with a making-current release circuit. The circuit shall be armed for approximately two cycles after breaker closing and shall operate for all peak fault levels above 25 times the ampere value of the rating plug.
 6. Trip units shall have selectable thermal memory for enhanced circuit protection.
 7. Trip units shall include the following individually adjustable time/current curve shaping solid-state elements:
 - a. Programmable long-time setting
 - b. Programmable long-time delay with selectable I^2t [and I^4t curve shaping – DT-1150+ only]
 - c. Programmable short-time setting
 - d. Programmable short-time delay with selectable flat or I^2t curve shaping
 - e. Programmable instantaneous setting including OFF position
 8. Circuit breakers, where indicated on the drawings, shall have individually adjustable ground fault current pickup and time, with selectable flat or I^2t curve shaping. Provide ground fault trip or ground alarm only as shown on the drawings.
 9. Circuit breakers, where indicated on the drawings, shall include an Arc Flash Reduction Maintenance System (ARMs)
 - a. The ARMs technology shall be provided to reduce arc energy during periods of maintenance. The system shall engage an independent, reduced instantaneous pickup and reduce total clearing time when activated.
 - b. The pick-up value shall be adjustable with a minimum of (5) settings to allow the greatest arc energy reduction without nuisance tripping.
 - c. With the ARMs technology active, total clearing time shall not exceed 40 msec for any fault currents above the pick-up value.
 - d. Activation and deactivation of the ARMs technology and local indication shall be accessible from the face of the trip unit without opening the circuit breaker door and exposing operators to energized parts. Recalibration or adjustment of trip unit parameters shall not be required when enabling / disabling the ARMs technology.
 - i. Breakers shall include a local, lockable ARMs activation selector switch and pilot light indication.
 - ii. Breakers shall include interposing relay to allow for remote ARMs activation from a remote contact closure and remote indication of ARMs status via an output relay.
 10. Trip units shall provide zone selective interlocking (ZSI) for the short-time delay and ground fault delay trip functions for improved system protection and arc energy reduction. For faults within the protected zone, the zone interlocking system shall override programmed time delays to allow the upstream breaker to trip with minimal time delay.
 - a. Factory shall wire for zone interlocking for the circuit breakers within the switchgear.
 11. Cause-of-trip LED indications shall include battery backup to indicate mode of trip following an automatic trip operation. A test pushbutton shall energize an LED to indicate the battery status.
 12. Trip units shall have provisions for a single test kit to test each of the trip functions.

13. Advanced Trip Unit Features [Digitrip 520MC]

- a. Trip units shall have a 4-character LCD display showing phase, neutral, and ground current. The accuracy of these readings shall be +/- 2% of full scale.
 - b. Trip units shall be equipped to permit communication via a network twisted pair to for remote monitoring. All monitored parameters and statuses shall be transmitted
- K. Ground fault protection shall be provided where indicated.
- L. Where indicated provide 100% rated UL listed circuit breakers.

2.8. ACCESSORIES

- A. Provide shunt trips, bell alarms and auxiliary switches as shown on the contract drawings.

2.9. MISCELLANEOUS DEVICES

- A. Key interlocks shall be provided as indicated on the drawings.
- B. Control power transformers with primary and secondary protection shall be provided, as indicated on the drawings, or as required for proper operation of the equipment.
- C. For outdoor (NEMA 3R) installations, each section of the switchboard shall be provided with a thermostatically controlled space heater. Power for the space heaters shall be obtained from a source as indicated on the drawings.

2.10. UTILITY METERING

- A. Where indicated on the drawings, furnish a barrier to separate the utility metering compartment complete with hinged sealable door. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company. Provide service entrance label and provide necessary applicable service entrance features per NEC and local code requirements.

2.11. SURGE PROTECTIVE DEVICE

- A. SPD shall comply with ANSI/UL 1449 4th Edition or later listing by Underwriters Laboratories (UL).
- B. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
- C. The SPD shall be of the same manufacturer as the switchboard.
- D. The SPD shall be factory installed integral to the switchboard by the original equipment manufacturer.
- E. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
- F. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD.
- G. All monitoring and diagnostic features shall be visible from the front of the equipment.
- H. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable single-mode modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
- I. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
- J. Electrical Noise Filter – Each Type 2 unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
- K. Type 2 units with filtering shall conform to UL 1283 5th Edition
- L. Type 1 units shall not contain filtering or have a UL 1283 5th Edition Listing.
- M. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
- N. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
 - 1. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
 - 2. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G

- 3. mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
- 3. For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes
- 4. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
- 5. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
- 6. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

O. Electrical Requirements:

- 1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
- 2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
- 3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards. End of life mode to be open circuit. Unit with end of life short-circuit mode are not acceptable.
- 4. Unit shall operate without the need for an external overcurrent protection device (OCPD), and be listed by UL as such. Unit must not require external OCPD or replaceable internal OCPD for the UL Listing.
- 5. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

Configuration	Protection Modes			
	L-N	L-G	L-L	N-G
Wye	•	•	•	•
Delta	N/A	•	•	N/A
Single Split Phase	•	•	•	•
High Leg Delta	•	•	•	•

- 6. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.
- 7. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

2.12. CUSTOMER METERING

- A. Where indicated on the drawings, provide a separate customer metering compartment with a front facing

hinged door and a UL listed microprocessor based multifunction power meter equal to Eaton PXM2280. Include current transformers wired to shorting-type terminal blocks for each meter. Provide fused potential taps as the potential source for metering as shown on the drawings.

- B. The meter surge withstand shall conform to IEEE C37.90.1 and ANSI C62.41.
- C. The meter shall accept a direct voltage input range of up to 576 Volts Line to Neutral, and a range of up to 721 Volts Line to Line.
- D. The meter shall accept a current input of up to 10 amps continuous. Startup current for a 5A input shall be no greater than 0.005A.
- E. Fault Current Withstand shall be 100 Amps for 10 seconds, 300 Amps for 3 seconds, and 500 Amps for 1 second.
- F. The meter shall have an accuracy of +/- 0.1% or better for volts and amps, and 0.2% for power and energy functions. The meter shall meet the accuracy requirements of ANSI C12.20 (Class 0.2%).
- G. The meter shall provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.
- H. The meter shall provide sampling at 400+ samples per cycle on all channels measured readings simultaneously.
- I. Meter shall provide per phase % THD and individual harmonic monitoring to the 40th order for current and for voltage L-N. Metered values shall include Volts, Amps, kW, kVAR, PF, kVA, Frequency, kWh, kVAh and kVARh. Provide 1 KYZ pulse output, on board meter limit exceeded alarms. Embedded web server shall support a waveform view of real time harmonic distortion and allow recording waveforms up to 64 samples per cycle. Meter shall have 768MB onboard memory for data logging.
- J. The meter shall provide user configured fixed window or sliding window demand.
- K. Meter shall provide a simultaneous voltage and current waveform recorder with programmable samplingrate.
- L. The meter shall allow up to 1500 events to be recorded.
- M. The meter shall be able to be configured and viewed from the on-board web server without the need for external software
- N. The meter shall include a three-line, bright red, .56" LED display.
- O. The meter must display a % of Load Bar on the front panel to provide an analog feel. The % Load Bar shall have not less than 10 segments.
- P. The meter shall support Modbus RTU, Modbus ASCII, DNP 3.0, Ethernet TCP/IP, Modbus TCP, BACnet/IP, SNMP v1 & v3 (Network), SMTP (email), HTTP and HTTPS communication.

2.13. ENCLOSURES

- A. NEMA 1 Enclosure
- B. Outdoor NEMA 3R Enclosure
 - 1. Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R UL requirements
 - 2. Enclosure shall have flat roof. Sloped slightly to drain.
 - 3. The enclosure shall be front accessible only, provided with bolt-on rear covers.
 - 4. Doors shall have provisions for padlocking.
 - 5. Ventilating openings shall be provided complete with replaceable fiber glass air filters.
 - 6. Where indicated on contract documents provide thermostatically controlled space heaters for each structure to prevent the accumulation of moisture.
 - 7. Power for space heaters, lights and receptacles shall be obtained from a source as indicated on the drawings.

2.14. NAMEPLATES

- A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.
- B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.15. FINISH

- A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.

PART 3 EXECUTION

3.1. EXAMINATION

- A. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- B. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. INSTALLATION

- A. Store, handle, and install switchboards and accessories per manufacturer's recommendations.
- B. Secure the assembly in place.
- C. Provide concrete housekeeping pad as indicated on the drawings for mounting of switchboard.
- D. Install overcurrent protective devices and controllers not already factory installed.
- E. Install filler plates in unused spaces.
- F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

3.3. IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 2 Section "Identification for Electrical Systems."

3.4. FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5. ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated in the coordination study.

3.6. TOUCH UP AND CLEANING

- A. Vacuum all backboxes clean of debris after installation and prior to contract closeout.
- B. Touch up scratch marks, etc. with matching paint.

3.7. DEMONSTRATION

- A. The Contractor shall provide a training session for the owner's representatives.
- B. A manufacturer's qualified representative shall conduct the training session. The training program shall consist of instruction on the operation of the assembly, circuit breakers, fused switches, meters, and major components within the assembly.

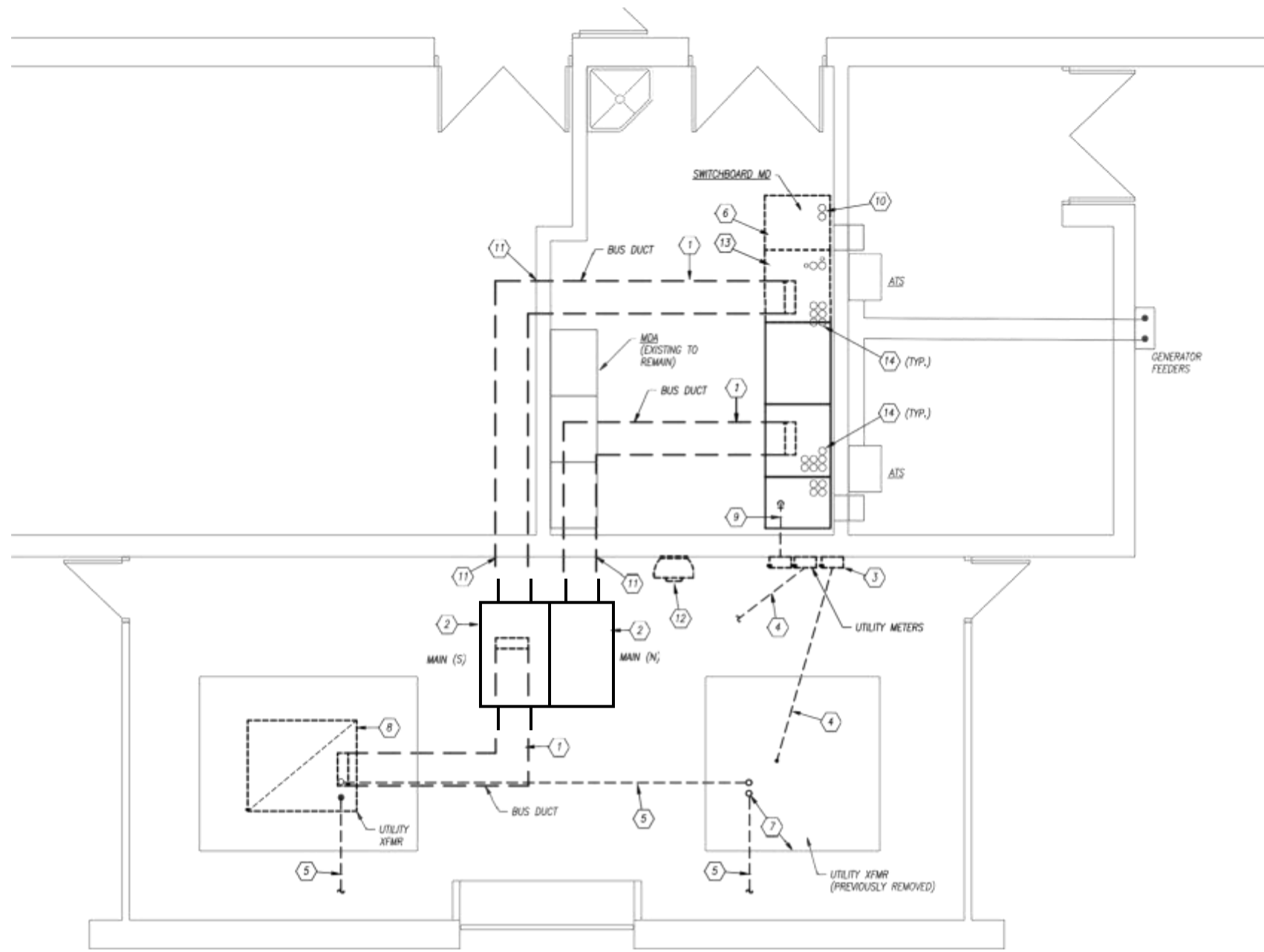
END OF SECTION 262413

TE PLAN
NO SCALE

02-06-20
SHEET NUMBER:

19.576

E0



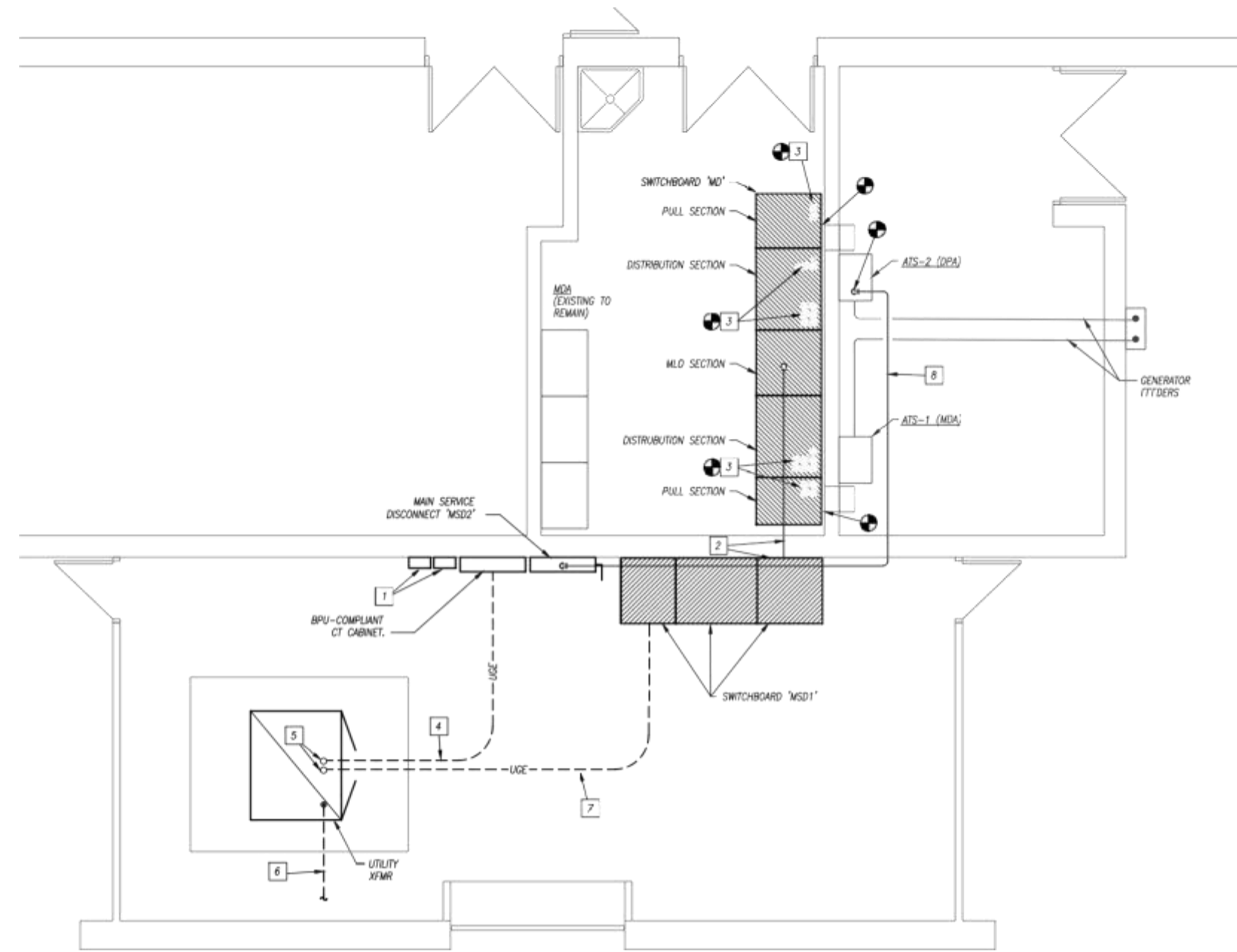
FLOOR PLAN - DEMOLITION - POWER
1/4" = 1'-0"

GENERAL DEMOLITION NOTES

1. REFER TO SCHEDULE NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.

DEMOLITION PLAN KEYED NOTES

- 1) REMOVE EXISTING BUS DUCT.
- 2) REMOVE EXISTING MAIN EXTERIOR SERVICE DISCONNECTS (NORTH AND SOUTH).
- 3) EXISTING UTILITY METERS TO BE REMOVED / RELOCATED AS REQUIRED. UTILITY METER FOR SOUTH UTILITY TRANSFORMER SERVICE TO BE RELOCATED. UTILITY METER FOR DIN TO BE RELOCATED. UTILITY METER FOR NORTH UTILITY TRANSFORMER (PREVIOUSLY REMOVED) TO BE REMOVED.
- 4) EXISTING UNDERGROUND METERING CONDUIT TO BE REMOVED.
- 5) COORDINATE LOCATION AND REMOVAL OF EXISTING LOOP FED PRIMARY WITH BPU PRIOR TO BEGINNING WORK.
- 6) REMOVE SWITCHBOARD 'MD' AND DISCONNECT ASSOCIATED BRANCH CIRCUIT WIRING, FEEDERS, ETC. TO BE RECONNECTED TO NEW SWITCHBOARD. REFER TO RISER DIAGRAM FOR MORE INFORMATION.
- 7) CAP EXISTING PRIMARY FEEDERS PER BPU UTILITY CONSTRUCTION STANDARDS. REMOVE PAD AS REQUIRED BY BPU AND NEW WORK CONDITIONS.
- 8) EXISTING UTILITY TRANSFORMER TO BE REMOVED AND PREPARED FOR NEW UNDERGROUND SECONDARY FEEDERS. COORDINATE ALL WORK WITH BPU UTILITY.
- 9) SUBSTRUCTIVE METER CONDUIT TO EXISTING METER TO BE REMOVED AND RELOCATED.
- 10) EXISTING FEEDERS THAT EXTEND TO BELOW SLAB SHALL REMAIN. NEW SWITCHGEAR SHALL HAVE CUSTOM PULL SECTION THAT ALLOWS THESE FEEDERS TO REMAIN IN PLACE. REFER TO RISER DIAGRAM FOR MORE INFORMATION.
- 11) PATCH WALL AS REQUIRED TO MATCH EXISTING. COORDINATE WITH SCHOOL DISTRICT.
- 12) REMOVE EXISTING PANK PATCH WALL AS REQUIRED. COORDINATE WITH SCHOOL DISTRICT.
- 13) UTILITY COMPANY CT'S FOR THE REC CENTER BUILDING TO BE REMOVED. DISCONNECT AND REMOVE ALL ASSOCIATED EQUIPMENT, WIRING, ETC. NOT REQUIRED TO REMAIN.
- 14) EXISTING UNDERGROUND FEEDERS TO BE MAINTAINED FOR RECONNECTION TO NEW GEAR (TYPICAL.)



FLOOR PLAN - POWER
1/4" = 1'-0"

GENERAL POWER NOTES

1. REFER TO SCHEDULE NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.

POWER PLAN KEYED NOTES

- 1) UTILITY METERS FOR SCHOOL SERVICE AND RECREATION BUILDING SERVICE. COORDINATE ALL WORK WITH BPU.
- 2) EXTERIOR SERVICE DISCONNECT (BREAKER) AND CT SECTION AND PULL SECTION. STUB CONDUITS OUT OF PULL SECTION OF EXTERIOR GEAR AND INTO BUILDING ABOVE INTERIOR SWITCHBOARD (IN PULL SECTION ABOVE SWITCHBOARD) AND DOWN INTO MLO SECTION OF SWITCHBOARD.
- 3) EXISTING FEEDERS THAT EXTEND TO BELOW SLAB SHALL REMAIN. EXISTING FEEDERS SHALL CONNECT TO NEW BREAKERS AS REQUIRED. REFER TO RISER DIAGRAM FOR MORE INFORMATION.
- 4) SERVICE LATERALS FOR 'DPA' RECREATION CENTER ELECTRICAL SERVICE. REFER TO RISER DIAGRAM FOR MORE INFORMATION.
- 5) STUB UP NEW SECONDARY FEEDERS INTO TRANSFORMER AND COORDINATE WITH BPU TO ENSURE A FINAL WORKING CONNECTION TO TRANSFORMER. COORDINATE ALL WORK WITH BPU.
- 6) COORDINATE ANY PRIMARY WORK WITH UTILITY COMPANY.
- 7) SERVICE LATERALS FOR SCHOOL ELECTRICAL SERVICE. REFER TO RISER DIAGRAM FOR MORE INFORMATION.
- 8) PROPOSED ROUTING OF UTILITY FEED TO ATS-2.



02/06/20
06/20

pkmr
ENGINEERS

PEARSON KENT MCKINLEY RAAF ENGINEERS LLC
13300 W 98TH STREET
913.492.2400
LENEKA, KS 66215
WWW.PKMRENG.COM

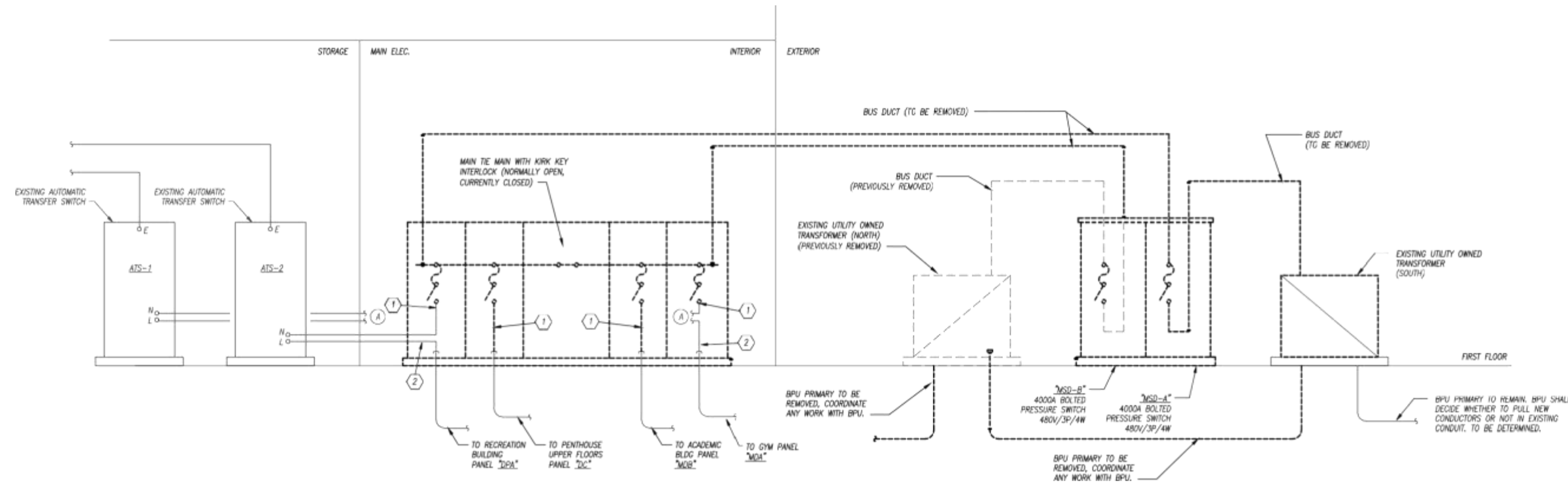
DWIGHT D EISENHOWER MIDDLE SCHOOL
ELECTRICAL SERVICE EQUIPMENT REPLACEMENT
 2901 NORTH 72ND STREET
 KANSAS CITY - KANSAS

ISSUED FOR:	
DESCRIPTION	DATE
1	
2	
3	© PEARSON KENT MCKINLEY RAAF ENGINEERS, LLC
DRAWN BY: JR	
CHECKED BY: MR	
SHEET TITLE: ELECTRICAL - FLOOR PLAN	
DATE: 02-06-20	PKMR PROJECT: 19-576
SHEET NUMBER:	



02/20/20
06/20/20

pkmr ENGINEERS
PEARSON KENT MCKINLEY RAAF ENGINEERS LLC
13300 W 98TH STREET
LENEKA, KS 66215
913.492.2400 WWW.PKMRENG.COM



- RISER DEMOLITION KEYED NOTES**
- DISCONNECT EXISTING FEEDER CONNECTION FROM LOAD SIDE OF SWITCH. MAINTAIN EXISTING FEEDER FOR RECONNECTION TO NEW GEAR. MAINTAIN AND PROTECT FEEDER DURING CONSTRUCTION.
 - DISCONNECT EXISTING FEEDERS AND MAINTAIN FOR CONNECTION TO NEW BREAKERS.
 - MAINTAIN EXISTING CONCRETE PAD.

ELECTRICAL RISER DIAGRAM - DEMOLITION
NO SCALE

EQUIPMENT FEEDER SCHEDULE						
FEEDER	EQUIPMENT	LOAD	FEEDER			CONDUIT
NO.		(AMPS)	SECS	# OF WIRES	SIZE	
F1	MAIN SERVICE DISCONNECT "MSD1"	1,200	9	4	500 MCM	3.5"
F1	MAIN SWITCHBOARD "MD"	100,000	2	4	500 MCM	3.5"
F2	MAIN SERVICE DISCONNECT "MSD2"	800	2	4	500 MCM	3.5"
F2	ATS-2 / BUILDING RECREATION PANEL "DPA"	800	2	4	500 MCM	3.5"

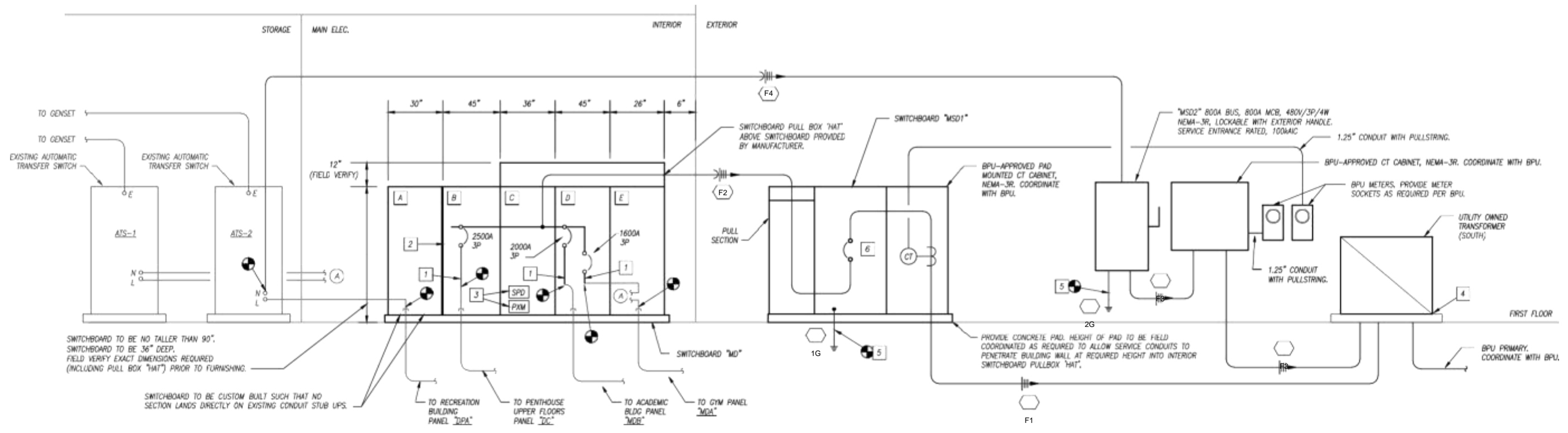
EXTERIOR MAIN SWITCHBOARD SCHEDULE				
PANEL DESIGNATION	MAIN BUS AMPS	VOLTAGE	MOUNTING	
MSD1	4000	480/277	CONCRETE PAD EXTERIOR	
	100,000	3Ø, 4W		
SCCR RATING (AIC):				
PHASEWIRE:				
LOCATION:				

INTERIOR MAIN SWITCHBOARD SCHEDULE				
PANEL DESIGNATION	MAIN BUS AMPS	VOLTAGE	MOUNTING	
MD	4000	480/277	FLOOR MAIN ELEC	
	100,000	3Ø, 4W		
SCCR RATING (AIC):				
PHASEWIRE:				
LOCATION:				

GROUNDING ELECTRODE CONDUCTOR SCHEDULE				
GROUND	EQUIPMENT	CONDUCTOR		CONDUIT
DESIGN		NO.	SIZE	
1G	MAIN SERVICE DISCONNECT "MSD1"	1	#3/0	1"
2G	MAIN SERVICE DISCONNECT "MSD2"	1	#3/0	1"

- REMARKS:**
- CUTLER HAMMER POW-R-LINE C SWITCHBOARD OR EQUAL.
 - ALL BREAKERS LARGER THAN 1200 AMPS SHALL BE PROVIDED WITH ARC FLASH MAINTENANCE REDUCTION SWITCHES (ARMS).
 - ALL BREAKERS LARGER THAN 1000 AMPS SHALL BE PROVIDED WITH GROUND FAULT PROTECTION.
 - ALL BREAKERS SHALL BE 100% RATED.
 - PROVIDE WITH UTILITY CT COMPARTMENT (BPU COMPLIANT).
 - PROVIDE WITH LOAD SIDE PULL SECTION.

- REMARKS:**
- CUTLER HAMMER POW-R-LINE C SWITCHBOARD OR EQUAL.
 - PROVIDE SWITCHBOARD WITH POWER DEMAND / kWh METER.
 - PROVIDE SWITCHBOARD WITH SURGE SUPPRESSION, 250KA.
 - ALL BREAKERS SHALL BE 100% RATED.
 - ALL BREAKERS LARGER THAN 1200 AMPS SHALL BE PROVIDED WITH ARC FLASH MAINTENANCE REDUCTION SWITCHES (ARMS).
 - ALL BREAKERS TO BE INSULATED CASE BREAKERS.
 - ALL BREAKERS LARGER THAN 1000 AMPS SHALL BE PROVIDED WITH GROUND FAULT PROTECTION.



- RISER DIAGRAM KEYED NOTES**
- MANUFACTURER TO EXTEND LUGGING DOWN AS REQUIRED TO ATTACH EXISTING FEEDERS. CONTRACTOR TO FIELD VERIFY REQUIRED LENGTH ABOVE FINISHED FLOOR AND COORDINATE WITH MANUFACTURER.
 - PROVIDE BARRIER BETWEEN THE PULL SECTION AND BREAKER SECTION.
 - PROVIDE SURGE PROTECTIVE DEVICE AND POWER DEMAND / kWh METER PER SWITCHBOARD SCHEDULE.
 - MODIFY EXISTING PAD AND TERMINATION POINTS AS REQUIRED FOR NEW TRANSFORMER. COORDINATE WORK WITH BPU.
 - CONNECT GROUNDING ELECTRODE TO MAIN BUILDING GROUNDING ELECTRODE (WATER PIPE AHEAD OF METER, EXISTING GROUND ROD, EXISTING CONCRETE ENCASED ELECTRODE). ADD NEW CONNECTIONS AS REQUIRED WHERE EXISTING CONNECTIONS ARE NOT VERIFIABLE. ADD NEW 6"-Ø" GROUND ROD WHERE ANY OF THESE CANNOT BE FIELD VERIFIED. PROVIDE #3/0 GROUND BOND JUMPER BETWEEN EACH SERVICE GROUND.
 - MAIN BREAKER.
 - DISCONNECT EXISTING FEEDER CONNECTION FROM ATS-2 LOAD SIDE FEEDER SERVING THE REC CENTER BUILDING AS REQUIRED TO REMOVE EXISTING SWITCHBOARD AND INSTALL NEW SWITCHBOARD. RECONNECT UPON INSTALLATION OF NEW SWITCHBOARD.

- SWITCHBOARD NOTES**
- PULL SECTION FOR REC CENTER BUILDING FEEDER SPACE. FULLY COMPARTMENTALIZED. NO BUSBARS.
 - DISTRIBUTION SECTION.
 - MAIN TERMINATION SECTION.
 - DISTRIBUTION SECTION. 2000A BREAKER STACKED ABOVE 1600A BREAKER.
 - PULL SECTION. NO BUSBARS.

DWIGHT D EISENHOWER MIDDLE SCHOOL
ELECTRICAL SERVICE EQUIPMENT REPLACEMENT
 2901 NORTH 72ND STREET
 KANSAS CITY - KANSAS

ISSUED FOR:	
DESCRIPTION	DATE
1	
2	
3	

© PEARSON KENT MCKINLEY RAAF ENGINEERS, LLC
 DRAWN BY: JR
 CHECKED BY: MR

SHEET TITLE:
ELECTRICAL - SCHED/DETAILS

DATE: PKMR PROJECT:

ELECTRICAL RISER DIAGRAM - NEW WORK

NO SCALE

02-06-20
SHEET NUMBER:

19.576

E2