SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Basic Electrical Requirements specifically applicable to all Division 26 – Electrical sections; in addition to the General and Supplementary Conditions of Contract, and Division 01 - General Requirements, applicable conditions of which are hereby incorporated by reference.
2. General Requirements:
   - a) Intent
   - b) Responsibility of Bidders
   - c) Quality Assurance
   - d) Products
   - e) Submittals
   - f) Substitutions
   - g) Guarantees
   - h) Applicable Publications
   - i) Regulatory Requirements
   - j) Project/Site Conditions
   - k) Delivery, Storage and Handling
   - l) Sequence and Scheduling
   - m) Type of Service
   - n) Incoming Electric Service Facilities
   - o) Interruption of Services
   - p) Temporary Electrical Service
   - q) Demolition
   - r) Cutting and Patching
   - s) Hazardous Materials
   - t) Short Circuit/Coordination Study & Arc. Flash Hazard Analysis
   - u) Operating and Maintenance Manuals
   - v) Record Drawings
   - w) Cleaning
   - x) Painting
   - y) Special Equipment Conditions

z) Electrical/Mechanical Sound Control

aa) Final Acceptance

bb) Owner Instruction

3. Products:

a) Vibration Isolators

b) Pipe Curbs; Equipment Supports; and Flashing

c) Firestopping

d) Electrical Identification

e) Concrete Work

f) Excavation, Backfilling and Shoring

B. Related Sections:

1. General Conditions and Supplementary Conditions of Contract.
2. All sections of Division 01 – General Requirements (as applicable).
3. All sections of Division 26 – Electrical.

1.2 INTENT

A. Provide complete and fully operational electrical systems with facilities and services to meet all of the requirements described herein and in complete accordance with all applicable codes and ordinances.

1. The term “provide”, as used in these specifications and on the drawings, shall be understood to mean “furnish and install, complete and operational, with all required hardware, accessories and appurtenances.” Unless indicated otherwise, this shall also include all associated power and/or signal wiring required for electrical systems furnished under this Contract.
2. The manufacturer's recommendations for the particular equipment or system, the National Electrical Code and the Architect/Engineer shall determine what is the complete and proper installation and proper operation.

B. Provide connections to all equipment furnished under other contracts and by Owner, including uncrating equipment, installing, starting, and testing.

C. Provide all temporary services and/or equipment as required for all installations.

D. Protect all equipment installed under this contract, until final acceptance of the project.

E. Test all equipment installed under this Contract and adjust the operation of such equipment, leaving all systems in perfect operating condition.

F. Upon completion of the work, thoroughly clean all equipment, leaving the job site and installation in first-class condition.

G. The drawings are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and quality and are not detailed installation instructions.

H. The Contractor will be held responsible for proper installation of materials and equipment to true intent and meaning of both Drawings and Specifications. All items of labor, material and equipment not specified in detail or shown on the drawings, but incidental to or necessary for the complete installation and proper operation of the several branches of work described herein or depicted on the drawings; or reasonably implied in connection therein; shall be provided as if called for in detail by the Drawings and/or Specifications.

I. In cases of discrepancies between drawings, or between the drawings and the specifications, the Engineer will make the final determination as to which is correct. In cases where items appear in the specifications but not on the drawings, or appear on the drawings but not in the specifications they shall be considered as noted on both. Unless written clarification in the form of an addendum is received, the bid shall be interpreted to include the most expensive installation, equipment or work and all associated costs.

J. The Engineer reserves the right of interpretation of the specifications and drawings. The Engineers decisions of interpretations shall be final.

1.3 RESPONSIBILITY OF BIDDERS

A. Examine all contract documents issued. Visit the site and become thoroughly acquainted with the existing conditions prior to submitting a proposal. The submission of a proposal shall be considered as evidence that a site visit was conducted; no extra compensation will be allowed for any error resulting from failure to visit job site. Prior to submitting a proposal, bidders must familiarize themselves with the codes, rules, and regulations in effect at the site of the work, to determine existing conditions that affect their installation.

B. Carefully examine the Architectural; Structural; Heating, Ventilating and Air Conditioning; Plumbing; Fire Protection; Electrical; Technology Systems and/or Miscellaneous Contract Drawings and Specifications. If any discrepancies occur between the drawings or between the drawings and specifications, report such discrepancies to the Architect in writing and obtain written instructions as to the manner in which to proceed. Do not make departures from the Contract Drawings without prior written approval of the Architect.

C. The terms “electrical contractor”, "the contractor" and "this contractor", mentioned in these Division 26 - Electrical specifications and on the Electrical drawings, refer to the Contractor responsible for all work and equipment included in these Division 26 - Electrical specifications.

1. Subcontractors: Any reference to, or letting of work contained in these specifications to, any Subcontractor or Manufacturer does not relieve this Contractor of his responsibility for all work, material and equipment in this specification.

D. In all cases where equipment and materials are specified in the singular or plural number, assume that such references shall apply to as many such items as are required to complete the installation.

E. Execute all work, construct and install all equipment in accordance with the current requirements of all Occupational Safety and Health Administration (OSHA), National Fire Protection Association (NFPA), the National Electrical Code (NEC) as amended to date, Underwriters Laboratories (UL), National Electrical Manufacturers Association (NEMA), owner's insurance underwriters and/or other authorities having jurisdiction over premises, public utilities which have connection with any systems specified, and all Federal, State, County and Local ordinances and regulations. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with the aforesaid codes, ordinances, or regulations. Contractor shall be held responsible for accident to persons, material or property caused by failure to adhere to the proper code requirements until the Owner has accepted work.

F. Contractor shall be qualified or licensed to perform the types of work involved under this Division of the Specifications in the state, county and/or municipality of this project as required.

G. Secure and pay for all permits, inspections and approvals required by foregoing authorities in connection with all work specified herein, unless otherwise noted. All costs associated with permits, inspections and approvals shall be included in the contract price unless directed otherwise. Obtain certificates of approval from departments responsible for issuing same. Deliver certificates in triplicate to the Architect/Engineer, at which time they shall become property of the Owner.

H. Wherever any installation, product, equipment item, etc. specified herein is not permitted to be handled or installed, or is otherwise restricted by union regulations, etc., notify the Engineer in writing before submitting a bid, in ample time for modifications in the requirements to be made. If such notification is not given, this Contractor shall be responsible to complete the installation as specified, to the Engineer’s satisfaction and at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least three years. See applicable specification sections for any additional requirements.
2. Equipment Service: Products shall be supported by a service organization that maintains a complete inventory of repair parts and is located reasonably close to the site.
3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
5. Nameplates: Nameplates bearing manufacturer’s name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or

trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

6. Underwriter's Labels: Where applicable, all material and equipment shall bear the label of approval of the Underwriter's Laboratory, Inc.

B. Manufacturer's Recommendations: Install materials in accordance with manufacturer's recommendations. Provide all required hardware, accessories and appurtenances as recommended by the manufacturer to complete the intended installation and function, even though such items may not be specifically called out or detailed on the drawings or in the specifications.

1. The term "manufacturer" as used in these Specifications or on the Drawings shall be understood as applying to a company of established reputation in the manufacture of the particular equipment, system or apparatus from products of their own make or others; and who assumes full responsibility for products utilized in said outfits, which are not manufactured by them.

C. Contractor is responsible for the means, methods, techniques, sequences, and procedures of construction and for worker safety.

1.5 PRODUCTS

A. Products, if any, named on the Contract Drawings or documents, and products of manufacturers named first throughout the Project Manual and/or documents, generally constitute the Engineer's Basis of Design, whether or not specifically denoted as such.

B. Products of named manufacturers appearing throughout the Project Manual and/or documents, or on the Contract Drawings or documents, other than the first named manufacturer, are accepted as Equal; however the requirements of the General Conditions regarding equipment shall apply.

C. Where three or more (Acceptable) Manufacturers are named, either in the specifications or on the drawings, contractor shall provide products by one these manufacturers only. Where fewer than three (Acceptable) Manufacturers are listed, and unless specifically indicated otherwise, contractor shall assume the phrase "Or Equal" and may submit standard product of any manufacturer, subject to compliance with these specifications and acceptance or Approval by the Engineer/Architect.

D. If products of manufacturers, other than those named first, differ from those named first in the Project Manual and/or documents, or on the Contract Drawings or documents, to the extent that their proper incorporation into the work requires changes to structural, piping, mechanical, electrical, and/or instrumentation work, or any other changes whatsoever in nature is required; then this Contractor shall be responsible for all such change(s) and all associated cost(s).

E. Thus, if the Contractor provide equipment other than the Engineer's Basis of Design, then the Contractor shall be responsible for all costs, by all trades, as required to accommodate the equipment provided.

1.6 SUBMITTALS

A. General Requirements Applicable to all Division 26 – Electrical sections:

1. Submit under provisions of Division 01 – General Requirements, and in accordance with the following:

a) Within 30 days after signing the contract, submit to the Architect/Engineer a complete list of proposed equipment and materials, giving the name and address of manufacturer and, when required for proper identification, trade names or catalog numbers. Itemize each type of material and each piece of equipment (omitting duplicates).

b) Submit samples of materials for approval at the site as requested by the Engineer. Such materials may be incorporated into the project after approval and serving their purpose as samples.

c) Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal. Produce shop drawings to indicate fabrication details and proposed layouts for shop or field fabrications as named herein.

d) Mark dimensions and values in units to match those specified. Include contract drawing identification, type, quantities, capacities, accessories, rough-in dimensions, manufacturer's name, model number, connection sizes, wiring diagrams, installation instructions, motor horsepower, voltage, phase and amperage, colors, finishes and other pertinent data.

e) Certify, by submittal, that the materials or equipment proposed are satisfactory for the intended application, and that the materials or equipment are in current production with no known plans to cease manufacture.

f) Submittals processed by the Architect/Engineer do not constitute change orders. The purpose of the submittal process is to demonstrate the Contractor's understanding of the design concept and intent; the Contractor demonstrates this understanding by indicating which equipment and materials he intends to provide and the fabrication and installation methods that he intends to use.

g) If deviations, discrepancies or conflicts between submittals and the contract documents (in the form of design drawings, specifications and addenda) are discovered, either prior to or after submittals are processed by the Architect/ Engineer, the contract documents shall control and shall be followed.

h) Submittals shall bear the Contractor's approval stamp as evidence that he has checked the drawings. <u>Any submittals without this stamp of approval will not be evaluated and will be returned to the Contractor for proper resubmission.</u> Material and equipment reviews by the Architect/Engineer are only for general conformance to the design intent of the project and compliance with information given in the contract documents. Dimensions shall be confirmed and correlated at the job site by the installing Contractor and installation shall be coordinated with

other trades. Specifically excluded from shop drawing review are equipment quantities.

i) Coordination composite drawings among the HVAC, Plumbing, Fire Protection, Electrical, Technology and Ceiling Contractors are required, with the lead role assigned to the HVAC Contractor. The HVAC Contractor shall prepare ¼" scale drawings with ductwork layout for review by other trades. The other Contractors shall then prepare and provide shop drawings to the HVAC Contractor, who will then prepare final layout and coordination drawings for the project as part of his contract price. The HVAC Contractor shall conduct coordination meetings with all other trades to discuss and resolve interference problems. Once each trade Contractor has initialed the coordination drawings to indicate approval, the HVAC Contractor shall submit the drawings to the Architect for review. The other trade Contractors should finalize their shop drawings in accordance with the coordination drawings, and submit for Architect's review.

j) The basis of this contract is for a maximum of two (2) reviews of any submittal by the Engineer. If additional reviews of a submittal are required for approval, the Contractor shall compensate the Engineer for additional process charges.

k) Electronic versions of the Electrical drawings may be obtained from the Engineer for a nominal fee.

B. Submittals are the contractor's documents; the Architect's and Engineer's approval constitutes an acknowledgment that the documents have been submitted and nothing more. It is the contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

C. Material and equipment reviews by Architect and/or Engineer are only for general conformance with the design concept of the project and compliance with information given in the Contract Documents. Specifically excluded from the Engineer's shop drawing review are material quantities, connection details, mounting trim, etc.

D. The Contractor is solely responsible for providing materials in conformance with the Contractor Documents. Dimensions shall be confirmed and correlated at the job site by the installing Contractor and installation shall be coordinated with other trades. Shop drawing approval does not modify the Contractor's duty to comply with the Contract Documents.

1.7 SUBSTITUTIONS

A. Refer to Division 01 – General Requirements.

B. Pre-Bid substitutions will not be accepted during the bidding phase. Any substitutions shall be submitted by the contractor for review and approval by the engineer during the submittal process.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalog number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, assume the

phrase "or approved equal", except that the burden is upon the bidder to prove such equality.

D. If the bidder elects to prove such equality, he shall request, in writing, review of the substitution by the Architect/Engineer in accordance with all Supplementary Conditions and/or Division 1 requirements. All such requests shall include manufacturer's literature, specifications, drawings, catalog cuts, performance data or other references or information necessary to completely describe the item.

E. The Contractor shall be responsible for all structural, mechanical, and electrical changes required for their installation, at no additional cost to the Owner.

F. A substitution request constitutes a representation that the Contractor:

1. Has investigated the proposed product and determined that it meets or exceeds the quality level of the originally specified product.
2. Will provide the same or greater warranty than the originally specified product.
3. Will coordinate the installation and make changes to all other work including coordination and compensation to other trades which may be required for the substituted product to be installed with no additional cost to the Owner.
4. Waive claims for additional costs or time extensions, which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

G. Whenever this contractor desires to furnish equipment of a manufacturer other than that specified or intended; the contractor shall include a complete specification of the substituted item along with each submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the contract specifications. Manufacturer's verification specifications shall be written as close as possible over the contract specifications so that an accurate comparison can be made.

H. The verification specification shall include the exact wording of the contract specification and the revised wording, identified properly, indicating all the deviations proposed. If no deviations are noted, the contractor shall furnish the material or equipment in accordance with the contract specifications.

I. Substitutions will be considered when a product becomes unavailable through no fault of the Contractor.

J. Also, when the contractor submits equipment or materials of the manufacturers specified, verification specifications shall be submitted when requested by the Architect or Engineer.

K. In cases where specific manufacturers are listed, the Engineer reserves the right to consider alternate manufacturers. In all cases where equipment and materials are specified as "Basis of Design", alternate manufacturers who meet the referenced Standards, these specifications and the standard of quality of the basis of design manufacturer may be submitted for consideration in accordance with the following:

1. It is not the intent of these specifications to be biased or proprietary unless a specific list of (three or more) “Approved Manufacturers” is given or an item is specified as “NO SUBSTITUTIONS”, “NO EQUAL”, etc.

2. The Engineer shall make the final determination of the equality of any proposed alternate manufacturers/equipment.

L. The Architect and Engineer reserve the right of final acceptance of all proposed substitutions.

M. Pre-Approval of a manufacturer and/or proposed system/equipment for bidding does not constitute Final shop drawing/submittal approval; nor does it guarantee same. Engineer reserves right to review and approve, comment on, or reject any and all proposed equipment during required submittal process, after award of contract, regardless of manufacturer being named Acceptable or Pre-Approved.

1.8 GUARANTEES

A. Guarantee all equipment, materials and workmanship and make good any defects in same for a minimum of one (1) year following date of acceptance of the project. Provide additional/special warranties where called for in the technical specifications.

1. Lamps shall be warranted for a period of three (3) months following date of acceptance.

2. Defects determined to be the result of misuse of apparatus by the Owner, his employees, tenants or building occupants shall not be covered by this warranty.

B. Warranty shall be in writing and shall include written copies of factory warranties with expiration dates on items of equipment where warranty date might differ from the acceptance date. No warranty shall start before date of acceptance in writing by the Architect. Repair or replace any defective work developing during this period, at no cost to Owner. Where defective electrical work results in damage to work of other contracts, this contractor shall be responsible to repair and/or restore such work to its original condition, again at no additional cost to Owner.

C. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives, as well as misrepresentations of such data. If the products have been installed in accordance with the manufacturer's published or written instructions and recommendations, and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and all associated work and materials, at no cost to the Owner.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents or applicable codes establish stricter standards.

C. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.

D. National Fire Protection Association (NFPA)

E. International Code Council (ICC)

F. National Electrical Manufacturers Association (NEMA)

G. Underwriters Laboratory (UL)

H. Institute of Electrical and Electronics Engineers (IEEE)

I. Illuminating Engineering Society of North America (IESNA), Lighting Standards and Recommended Practices

J. American National Standards Institute (ANSI)

K. ADA Accessibility Guidelines for Buildings and Facilities (ADAAG)

1.10 REGULATORY REQUIREMENTS

A. Electrical: Conform to the latest requirements of the National Electrical Code and the International Code Council Electrical Code. In addition, all applicable Federal, State, Municipal or other authority laws, rules and regulations shall apply.

B. Conform to all applicable utility company rules and regulations. Owner shall pay fees associated with utility connections.

C. Secure and pay for any and all permits and inspections required by any of the foregoing authorities having jurisdiction, and pay all other costs in connection with the work, unless otherwise noted.

D. Comply with the latest requirements for the protection from fire and panic of the Department of Labor and Industry of the Commonwealth of Pennsylvania/the Pennsylvania Uniform Construction Codes.

E. Underwriters' Laboratories (UL) listings and National Electrical Manufacturer's Association's (NEMA) stamps or seals shall be evidenced where applicable to electrical apparatus.

F. Conform to applicable regulations of Department of Environmental Protection, Department of Labor and Industry, and OSHA. Comply with applicable safety related work practices described in NFPA-70E.

G. Secure rough-in and final wiring certificates from the Middle Department Inspection Association or other independent inspection agency acceptable to the Engineer. Provide certificates in triplicate and deliver to the Architect prior to project close out.

H. Updated Standards: At the request of the Architect/Engineer, submit a change order proposal where an applicable industry code or standard has been revised and reissued after

the date of contract documents and before performance of the work affected. The Architect/Engineer will decide whether to issue a change order to proceed with the updated standard.

1.11 PROJECT/SITE CONDITIONS

A. Refer to Division 01 - General Requirements.

B. Install work in locations shown on the drawings, unless prevented by project conditions.

C. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of the Architect and/or Engineer before proceeding.

D. Perform all minor cutting and patching, and make all changes, relocations and installations with a minimum of noise. All present and new equipment, floors, walls, etc., shall be adequately protected from dust and dirt caused by the work. Protection shall include suitable temporary barriers or coverings. Maintain exterior and interior premises of the building as clean as possible during construction. At no time shall the Contractor interfere with the normal operation of the building by allowing debris, excess earth, etc., to remain on the premises.

E. Generally, inspection and maintenance should only be performed on equipment to which power has been turned off, disconnected and electrically isolated so that no accidental contact can be made with energized parts. Follow all manufacturer's warnings and instructions.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 01 - General Requirements.

B. Deliver materials and equipment to the project site in a clean condition with openings plugged or capped (or otherwise sealed by packaging) both during shipping and during temporary storage. Deliveries shall be scheduled to minimize the amount of time in temporary storage.

C. Delivered equipment crating and/or packaging shall clearly identify pick points or lifting points. In the absence of crating or packaging, pick points or lifting points must be identified on the equipment.

D. When unloading materials and equipment provide special lifting harness or apparatus as may be required by manufacturers. Handle materials and equipment in accordance with manufacturer's written instructions.

E. Determine the required equipment needed for unloading operations and have such equipment on site to perform unloading work on the date of equipment delivery.

F. Store materials on site only where directed by the Owner. Materials and equipment, both on site and off site, shall be stored in accordance with manufacturer's written instructions. Store all materials in dry locations, off ground and keep moisture free at all times.

G. Throughout construction, Contractor shall protect, at his own expense, all work, materials, and equipment furnished and/or installed under this Division. Units and devices both before and after being set in place, shall be securely protected from carelessly or maliciously dropped tools, materials, grit, dirt or any foreign matter. Contractor shall be held responsible for damage so done until work is fully and finally accepted.

H. The Contractor shall be entirely responsible for all apparatus, equipment and appurtenances furnished by him or his subcontractors in connection with the work, taking special care to protect all parts thereof in such manner as may be necessary or as may be directed.

1. Protection shall include covers, crating, sheds or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment.

I. Materials and equipment shall be stored in areas designated by the Owner and/or the General Contractor. Where equipment must be stored outside the building, it shall be totally covered and secured with heavy, waterproof tarps and kept dry at all times. Where equipment has been subjected to moisture, it shall be suitably dried out before being placed in service.

J. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products and equipment to assure that they are being maintained under specified conditions, and free from damage or deterioration.

1.13 SEQUENCING AND SCHEDULING

A. Refer to Division 01 - General Requirements.

B. Interference:

1. The drawings are generally diagrammatic and indicative of the work. The Contractor is responsible for modifying the work with offsets, bends, or other fittings to avoid minor interference's and structural obstructions. Perform such modifications at no increase in cost to the Owner.

2. Construct electrical systems in a manner not to delay or interfere with other operations of work in the project.

3. Prior to making electrical installations, coordinate electrical work locations with other operations of work, especially in congested areas such as mechanical rooms and above hung ceilings (if applicable).

4. In the event that interferences develop, the Architect/Engineer’s decision shall be final and no additional compensation will be allowed for relocation of work/equipment of this Division - regardless of which work or equipment was installed first.

C. Contract Interface:

1. Work performed in cooperation with other contracts: The responsibility for performing work of this contract in cooperation with work of other contracts rests solely with this Contractor.

a) Prior to rough-in, coordinate exact electrical requirements and characteristics for all electrically-operated equipment with contractor furnishing same.

b) Make connections of electrical systems specified in the various sections of this contract to those systems or installations of other contracts requiring such connections.

1.14 TYPE OF ELECTRIC SERVICE

A. Secondary Service - 120/208V-3 phase, 4 wire, 60 Hertz alternating current.

1.15 INCOMING ELECTRICAL SERVICE FACILITIES

A. Provide all electrical facilities as shown on the drawings and as hereinafter specified for the establishment of new secondary electric and telecommunication (telephone, CATV, etc.) service facilities. This shall include furnishing and installing all grounding conductors, manholes, transformer foundations, secondary conduits, secondary conductors, and site/building access conduits for telecommunication utilities, as shown on the drawings.

B. Installations shall be in accordance with all applicable Utility Company requirements, rules and regulations. All required raceways, fittings, meter bases, terminations, etc. shall be verified with the respective Utility Company prior to installation.

C. Refer to section 260533 – Raceway and Conduit for Electrical Systems, for additional and general requirements for underground conduits and ductbanks.

1.16 INTERRUPTION OF SERVICES

A. Refer to Division 01 - General Requirements.

B. At the beginning of the project, review Owner’s procedures relating to utility interruptions and plan the work of this Division accordingly. Develop a preliminary utility interruption schedule and submit to the Owner for approval before developing final project schedules.

C. Schedule the work to avoid major interruptions of any utility services. Interruption of services shall be done during overtime or weekend hours, if necessary, at no additional cost to the Owner.

D. Notify Owner’s representative a minimum of five (5) working days prior to any interruption of services.

1.17 TEMPORARY ELECTRICAL SYSTEMS

A. Refer to Division 01 - General Requirements.

B. Do not use permanent electrical systems for temporary purposes without prior written permission from the Owner.

C. The use of permanent electrical systems for temporary purposes shall not modify the terms of warranty.

1.18 DEMOLITION

A. The intent is to demolish all work as shown on the drawings and as required for new installations. The drawings are diagrammatic in nature and are intended to represent only the general scope of demolition; neither the demolition drawings or notes shall be considered as all inclusive. The contractor shall review the existing facility, along with the demolition drawings, and shall be responsible to determine the exact extent of the electrical demolition work required to fulfil the intent of the contract documents.

B. This contractor shall disconnect and remove any electrical circuits (120V and above), connections (and associated wiring or conduit) from other trades work that involves electrical connections. Contractor shall reference other trades drawings and determine the exact extent of demolition work required.

C. Perform all demolition work with care and protect portions of the existing installation that are to remain from damage. Damage to existing building equipment, systems, finishes, etc. so incurred shall be repaired by this contractor at no additional cost.

D. Restore damaged or defaced work remaining in place to its original condition.

E. Existing equipment and materials, removal of which is not indicated by the contract documents or required to accomplish the project intent, shall remain unless noted otherwise.

F. Refer to the new work drawings for additional information which may affect demolition work, prior to beginning demolition.

G. Disconnect and remove any ceiling mounted devices that interfere with removal of existing ceiling; store for reinstallation. Retain all associated wring and conduit for reinstallation.

1.19 CUTTING AND PATCHING

A. Refer to Division 01 - General Requirements; Division 07 – Thermal and Moisture Protection; and Division 09 - Finishes.

B. Perform all cutting and patching required for the installation of work under this Division unless noted otherwise. Refer to appropriate sections of Division 09.

C. Perform finishing and roof flashing in areas of existing building or roof not being disturbed under general construction, for installation of work under this Division. Refer to appropriate sections of Division 07.

1. Where openings are to be made in existing roof, obtain bonding company approval, if roof bond is still in effect, before such openings are made.

D. Obtain approval from Owner’s representative before cutting of any existing work or building construction.

E. All existing surfaces shall be repaired and finished to match existing adjacent surfaces. Repair all disturbed areas, drives, roads, streets, and grass areas where these surfaces have been disturbed by installation of work under this Division, unless these areas are also being disturbed by work under the General contract.

F. All openings must be neatly drilled, bored or cut in a workmanlike manner, with materials and equipment suitable for the purpose. Punching or chipping of concrete will not be permitted. All openings shall be drilled, bored or cut in a manner satisfactory to and at locations approved by the Architect.

G. Materials damaged under this contract shall be patched or replaced as directed by the Architect.

1.20 HAZARDOUS MATERIALS

A. Refer to appropriate sections of Division 02 – Existing Conditions.

B. Should hazardous or toxic materials be encountered in any existing work, notify the Owner immediately. Do not disturb surfaces or equipment containing hazardous materials without written authorization of the Owner/Architect. All such materials, equipment or components removed by this contractor shall be properly disposed of in accordance with applicable rules and regulations.

C. No known hazardous or toxic materials shall be incorporated into the final construction or any equipment provided under this Contract.

D. Hazardous or toxic materials utilized as a construction aid shall not be stored within the building and shall be removed promptly from the job site when no longer required.

1.21 SHORT CIRCUIT/COORDINATION STUDY & ARC FLASH HAZARD ANALYSIS

A. This contractor shall provide short circuit and protective device coordination studies and an arc flash hazard analysis for the electrical distribution system/equipment represented by the Electrical One-Line Diagram.

1. The intent of the Arc Flash Hazard Analysis is to determine potential hazards that exist at each major piece of electrical equipment shown on the One-Line Diagram.

2. Studies and analysis shall be prepared by an Approved professional engineer or Approved engineering firm, familiar with and knowledgeable of the project details; or by the Manufacturer of the electrical distribution equipment.

B. The scope of the studies and analysis shall include all new components of the electrical distribution system supplied by the equipment manufacturer under this contract.

C. Electrical system equipment (in other than individual dwelling units) that are likely to require examination, adjustment, servicing or maintenance while energized shall be field marked (labeled) to warn qualified individuals of potential arc flash hazards in accordance with NEC Article 110.16.

1. This includes, but is not necessarily limited to: switchgear, switchboards, panelboards and/or loadcenters, motor control centers, uninterruptible power supplies, power distribution units (PDU's), emergency generator, automatic transfer switches, transformers, bus ducts, disconnects, safety switches, enclosed circuit breakers, CT cabinets and control panels supplied via the power system.

   a) The study shall include normal power operation and emergency power operation where an emergency generator is provided.

   b) Shall also include large HVAC equipment and motors (over 5hp). Contractor shall coordinate with mechanical contractor for equipment sizes.

2. The arc flash hazard analysis will include creation and application of Arc Flash Hazard Warning Labels affixed to each piece of electrically power equipment.

D. Service equipment (in other than individual dwelling units) shall be field marked (labeled) with the maximum available fault current. Field marking(s) shall include the date the fault current was calculated. Markings shall be sufficiently durable to withstand conditions of the environment involved.

1. When modifications to the electrical installation occur that affect the maximum available fault current at the service, verify/recalculate maximum available fault current as necessary to ensure service equipment ratings are sufficient for the maximum available fault current expected at the line terminals of the equipment. Adjust field marking(s)/ relabel service equipment to reflect new level of maximum available fault current.

E. Perform short circuit and protective device coordination studies for the electrical distribution system before performing the Arc Flash Hazard Analysis. Use of NFPA-70E Task tables to determine Arc Flash Hazard Category ratings shall NOT be acceptable.

F. Studies shall incorporate and reference a comprehensively detailed system one-line diagram, with specific reference to the equipment manufacturer which the contractor is approved to use. This diagram and document shall include exact model numbers, frame designation, trip unit and trip plug details, etc., as applicable for all equipment and protective devices.

G. Compare calculated results from the short circuit study to equipment short circuit ratings. Verify that all equipment is properly rated for the available short circuit current.

H. Utilize results of the protective device coordination study to determine proper settings for protective devices. For complex systems, create time-current curves to verify and determine appropriate protective devices sizes and settings. Adjust settings of installed protective devices in the field, or shipped from factory, in accordance with study results as part of equipment start-up/project close out.

I. Short circuit and protective device coordination studies shall be performed PRIOR TO releasing an order for any equipment included in said studies.

J. Submit short circuit and protective device coordination studies for Engineer's review/approval prior to receiving final approval of associated distribution equipment. Include as part of the appropriate electrical equipment submittal.

1. Contractor shall submit the study and associated distribution equipment at the earliest possible time as not to delay the project. This timeframe shall consider the engineer review time and possible adjustments to the study to facilitate a final study that ensures that all selections of devices and characteristics appear satisfactory.
2. It shall be allocated to have an initial review of the study performed by Engineer. The study shall then be revised accordingly based on any subsequent comments / adjustments from the Engineer; An final study will be performed and submitted to ensure that all selections of devices and characteristics appear satisfactory. This shall be submitted for final Engineer approval.
3. Denote in equipment submittals any short circuit or protective device ratings which require revision in accordance with study results; a proposed solution shall also be provided for engineer review.

K. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Engineer may be obtained based on preliminary submittal of sufficient study data to ensure that the selection of device and characteristics appears satisfactory.

L. Summarize results of short circuit and protective device coordination studies and arc flash hazard analysis in a Final report and include in Operating and Maintenance Manuals.

M. Contractor shall be responsible to contact the utility company to obtain any information required for the study that relates to the incoming service from the utility point of contact.

1.22 OPERATING AND MAINTENANCE MANUALS

A. Submit under provisions of Division 01 – General Requirements, and in accordance with the following:

B. Provide heavy-duty catalogue binders with appropriate labeling.

C. Binders shall be indexed by material and/or system type and at a minimum shall include:

1. Title page with clear plastic protection cover.
2. List of Drawings.
3. Description of Systems: Provide complete and detailed description of systems.
4. Operating Division: Provide complete and detailed operation of major components.
5. Maintenance Division: Provide preventative maintenance schedule for major components.
6. List of Equipment Suppliers and Contractors: Provide list of equipment suppliers and contractors, including address and telephone number.
7. Certification: Include copy of tests performed on insulation, grounding, continuity, phase balancing and signal systems; electrical equipment tag identification and wiring color code; inspection approval certificates for electrical systems and operational tests on applicable electrical equipment.

8. Shop Drawings and Maintenance Bulletins: Provide materials received in compliance with clause 'Shop Drawings', arrange alphabetically.

9. Short Circuit and Protective Device Coordination Studies and Arc Flash Hazard Analysis: final report summarizing results.

D. Divider Tabs: Laminated Mylar plastic and colored according to Section.

E. Submit documents for approval prior to being turned over to the Owner.

1.23 RECORD DRAWINGS

A. Submit under provisions of Division 01 – General Requirements, and in accordance with the following:

B. Keep on site at all times an extra set of drawings and specifications recording changes and deviations from contract documents including all addendum, bulletin and request for information data. Documents shall be updated on a daily basis. This set of documents shall be used specifically for this purpose.

C. The record drawings shall accurately reflect the as-built conditions at the time of the project completion.

D. Record drawings shall be presented with maintenance manuals to the Architect for approval at the time of final acceptance of the project, prior to being turned over to the Owner.

1.24 CLEANING

A. Refer to Division 01 - General Requirements.

B. Prior to the date set for final inspection and at the direction of the Architect, all new lighting fixtures, switch and receptacle plates, engine generator and electrical distribution equipment, in general, shall be cleaned as required to remove plaster, dust, paint splashes, labels, etc. from the equipment and fixtures.

C. Any damage in the electrical system or other damage to any part of the building, its finish or furnishings, due to failure to properly clean electrical equipment and or associated components, shall be repaired by this Contractor at no additional cost to the Owner.

1.25 PAINTING

A. Refer to Division 01 - General Requirements; and Division 09 – Finishes.

B. Prepare for painting of exterior surfaces of unfinished materials, equipment, ironwork, etc. exposed in finished areas by cleaning surface of foreign matter, grease, dirt, and dust.

C. Paint exposed items or equipment, and all structural steel or miscellaneous metal, installed under this portion of the specifications.

D. Refer to Painting section(s) of the specifications under Division 09. Surfaces shall be primed and finish painted. Each coat shall be a different shade, with final coat of the color as selected by the Architect.

E. Paint on factory finished equipment chipped or scrapped during installation shall be touched up. Touch up paint to be supplied by equipment manufacturer.

1.26 SPECIAL EQUIPMENT CONDITIONS

A. In general, starters and special control equipment required for heating and ventilating equipment, such as condensate pumps, air-handling units, unit heaters, fans, power roof ventilators, etc., shall be furnished by the HVAC Contractor and delivered to the Electrical Contractor for installation and final power connections. The Electrical Contractor shall provide associated power wiring.

1. Control wiring in conjunction with the temperature/building control system, except where shown or specified otherwise, shall be provided under the Automatic Temperature Control section of the HVAC Contract.

B. The HVAC Contractor shall install control panels for air-handling units, ATC system, cooling towers, etc. The Electrical contractor shall provide a 120 VAC (input power) connection to the main ATC/DDC panel; and to other ATC/DDC sub-panel(s), when indicated on the drawings. The HVAC contractor shall be responsible for any and all other line- or low-voltage wiring and connections required for control panel(s), sensors, dampers, actuators, etc.

1. Control panels furnished with or integral to a specific piece of equipment (such as for a cooling tower or air-handling unit, for example) shall generally derive control power from the equipment/motor feeder circuit and include required control transformers.

2. Feeders for equipment operating at 208 or 240 VAC shall include a dedicated neutral conductor with the phase conductors, whether specifically denoted in the panel schedule or not, to allow for 120 VAC control power to be derived directly from the circuit.

C. In general, starters and special control equipment required for electrically operated equipment furnished under the Plumbing Contract shall be furnished by the Plumbing Contractor and delivered to the Electrical Contractor for installation and final power connections. The Electrical Contractor shall provide associated power wiring.

1. Control wiring in conjunction with plumbing systems, except where shown or specified otherwise, shall be provided under the Plumbing Contract.

D. The Plumbing Contractor shall install control panels for sump pumps, domestic water pressure booster pumps, sewage ejector pumps, etc. The Plumbing contractor shall be responsible for any and all required line- and/or low-voltage wiring between the control panel and associated pumps, floats, sensors, control devices, etc.

1. Control panels shall generally derive control power from the equipment/motor feeder circuit and include required control transformers.

2. Feeders for equipment operating at 208 or 240 VAC shall include a dedicated neutral conductor with the phase conductors, whether specifically denoted in the

panel schedule or not, to allow for 120 VAC control power to be derived directly from the circuit.

E. For electrically-operated equipment not furnished under Division 16 and shown on the drawings as wired by the Electrical contractor and provided by others or Not In Contract (N.I.C.), i.e. pumps, etc., the associated starters and special control equipment shall be furnished by the equipment supplier and delivered to the Electrical contractor for installation and final power connections.

1. Control wiring in conjunction with this equipment, except where shown or specified otherwise, shall be provided by the equipment supplier.

F. Unless otherwise detailed on the drawings, rough-in of proper size and capacity of mechanical equipment indicated on the drawings as “Future” or “N.I.C.” shall be provided and installed in such a manner and location that future final connections can be made with a minimum of work and without cutting or patching permanent walls, partitions, ceiling or floors.

G. Engineering drawings are, of necessity, schematics for special equipment as exact roughing-in and requirements may vary with different manufacturers. Each trade shall connect its respective services to all special equipment indicated on the drawings at no additional cost to the Owner.

1.27 ELECTRICAL/MECHANICAL SOUND CONTROL

A. All equipment shall operate without objectionable noise or vibration within Noise Criteria Curves listed in Sound Control Fundamentals of the latest edition of the ASHRAE Handbook of Fundamentals. Sound and vibration measurements shall conform to the ASHRAE Handbook of Fundamentals. If such objectionable noise or vibration shall be produced and transmitted to occupied portions of the building by electrical/mechanical equipment (i.e. generators, transformers, etc.) or other parts of this work, any necessary changes, as approved shall be made without additional cost to the Owner. Noise levels shall conform to the requirements of OSHA.

B. Any and all other insulation or isolation required to accomplish results specified above shall be furnished and installed without additional cost to the Owner.

C. Isolation systems shall be installed in strict accordance with the manufacturer’s written instructions and submittal data. Locations of all vibration isolation products shall be selected for ease of inspection and adjustment, as well as for proper operation.

D. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.

1.28 FINAL ACCEPTANCE

A. Refer to Division 01 - General Requirements.

B. When the installation is reported in writing by the contractor to be complete and ready for acceptance, an inspection shall be made by the Contractor and in the presence of the Engineer

to ascertain whether it complies with the contract documents. If in the opinion of the Engineer it fails to do so, the Contractor shall at once remedy all defects and shortcomings.

C. Any additional tests that may be required shall be entirely at the Contractor's expense.

D. All testing work shall be done when and as directed by the Engineer.

1.29 OWNER INSTRUCTION

A. Refer to Division 01 - General Requirements.

B. Furnish the services of qualified personnel, approved by the Engineer and thoroughly familiar with the completed installation, to instruct the Owner’s permanent operating personnel in the proper operation of all systems included under this contract and the proper care of all equipment and apparatus. Unless required otherwise in the technical sections of this specifications, these services shall be furnished for a period of one (1) 8-hour day, after the operation of the systems has been taken over by the Owner.

C. When instructions are provided under this contract, the Contractor shall have in his possession three (3) copies of an identifying letter which shall list the names of the Contractor's qualified instruction personnel, including manufacturers' representatives and subcontractors that will be giving the instructions. Likewise, on this same letter, spaces shall be provided for the Owner's personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor's representatives and subcontractors shall sign and date the letter, and the Owner's personnel shall sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One signed copy shall be delivered to the Owner, one copy to the Engineer and one copy shall be retained by the Contractor.

D. In addition to the instructions outlined above, the Contractor and his manufacturers' representatives and subcontractors shall furnish written basic instructions indicating the proper operation of each system and associated equipment. Each manufacturer shall also submit a brochure on his equipment, including instructions on operation, recommended spare parts, and instructions on preventative, routine and breakdown maintenance.

E. Combine the written instructions and the manufacturers' equipment brochures in complete volumes with hardback binders which shall be turned over to the Owner before final acceptance of the contract work. The Contractor shall obtain two (2) copies of a signed receipt from the Owner for the written instructions and equipment brochures. One copy of the receipt shall be delivered to the Engineer and one copy retained by the Contractor.

2 PRODUCTS

2.1 VIBRATION ISOLATORS

A. Neoprene Isolation Pads:

1. Neoprene isolation pads shall be single rib or crossed, double rib neoprene in shear pads, in combination with steel shims when required, having minimum static deflections as tabulated. All neoprene pads shall be true neoprene in-shear using alternately higher and lower ribs to provide effective vibration isolation,

and shall be molded using 2500 psi tensile strength, oil resistant, compounds with no color additives. Pads shall be 45 or 65 durometer and designed to permit 60 to 120 psi loading, respectively, at maximum rated deflections. Neoprene in-shear isolation pads shall be provided to meet tabulated minimum operating static deflections without exceeding published maximum static deflections. Use single or, crossed, double rib or laminated composites of both as required. When two pads of ribbed material are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate.

2.2 PIPE CURBS, EQUIPMENT SUPPORTS, AND FLASHING

A. Prefabricated curbs and supports:

1. Roof Pipe Curbs: Minimum 18 gauge galvanized steel construction with continuously welded corner seams, factory installed wood nailer and 1-1/2”, 3 pound density rigid fiberglass insulation, acrylic coated ABS plastic cover with required number of openings for piping and conduit, and graduated step neoprene boots with stainless steel clamping bands. Style shall be coordinated with roof construction. Minimum height shall be 12” above finished roof surface.
2. Roof Equipment Supports: Minimum 18 gauge galvanized steel construction with continuously welded corner seams, factory installed 2x4 wood nailer and 18 gauge galvanized steel counter-flashing and screws. Style shall be coordinated with roof construction. Minimum height shall be 12” above finished roof surface.

B. Pipe Boots: Minimum .060” thick EPDM, neoprene, or Hypalon, ozone and ultraviolet resistant, minimum service temperature range of -60°F to 270°F, 3’ base flange, conical shaped steps with double thick molded ribs for each pipe size, stainless steel clamps.

C. Sheet copper flashing: Conform to ASTM B 152, weight not less than 8 ounces per square foot.

D. Sheet lead flashing: Weight not less than 3 pounds per square foot for field constructed flashings and not less than 2-1/2 pounds per square foot for prefabricated flashings.

2.3 FIRESTOPPING

A. Refer to appropriate sections of Division 07 for additional information and requirements.

B. Compliance

1. In accordance with IBC requirements and Authority Having Jurisdiction.
2. ASTM: E84-96 and E814-94
3. Factory Mutual Engineering and Research Corporation (FM)
4. Underwriters Laboratories, Inc. (UL): 1479
5. Warnock Hersey (WH)

C. Materials

1. Use either factory built firestop devices or field erected through-penetration firestop systems to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
2. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 4 in nominal pipe or 16 sq. in. in overall cross sectional area.
3. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.
4. Firestop sealants used for firestopping or smoke sealing shall have following properties:
   a) Contain no flammable or toxic solvents.
   b) Have no dangerous or flammable outgassing during the drying or curing of products.
   c) Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
   d) When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
5. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
   a) Classified for use with the particular type of penetrating material used.
   b) Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
   c) Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
6. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
7. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
8. Materials shall be asbestos free.

2.4 ELECTRICAL IDENTIFICATION

A. Identification labels (Nameplates) for equipment shall be standardized for the project at 1/16” thickness, by 3” in length, by 1” in height, having engraved white letters 1/4" height on a black background.

1. Exceptions shall be made to increase size (as approved by the engineer) for field requirements or other needs requiring a different length, etc. to satisfy conditions.

B. Labels shall be manufactured of engraved Phenolic Plastic, Micarta or Bakelite with pressure-sensitive adhesive backing, and shall be colorfast. Flexible plastic punched tapes are not be acceptable. Nameplates shall be electrically non-conductive with beveled edges Adhesive backing shall be chemically compounded to hold tight and fast at wide temperature extremes and environments. Equipment or item to receive the adhesive backed label shall be cleaned per label makers recommendations prior to application. Additionally, all labels shall be secured with screws or rivets. Coordinate labels with those being supplied under other contracts.

C. Nameplates shall conform to Military Standard LP 387A Type N.D.P. LP 509

D. Labels shall be as manufactured by Seton NamePlate Company, Bunting Company, Brimar Industries, or approved equal.

2.5 ACCESS PANELS

A. Furnish factory-fabricated access panels for access to all concealed pull boxes, junction boxes, capped conduits and other electrical equipment where no other means of access is available. Access panels for electrical work, along with all required auxiliary or supporting steel, hardware, etc, shall be furnished by the electrical contractor to the general contractor, who shall install them. Access panels are not required at lift-out removable tile ceilings.

B. Access panels shall be of appropriate size but not less than 18" x 12". Panels shall be flush type, hinged to drop down and out, screwdriver operated, stainless steel in masonry and tile work and prime-coated sheet steel in plaster or acoustical tile of all types.

C. At locations where access panels are installed in fire-rated ceilings, access panels shall contain the 1-1/2" hour fire-rated "B" label, and, in addition, shall also be provided with layers of gypsum wallboard in a thickness which will supply an additional one-hour fire rating. Coordinate rated ceiling requirements with the Architectural drawings.

D. Determine the exact locations and sizes of required access panels and coordinate same with the Architect. Access panels shall not be installed without prior approval of the Architect. All panels shall be installed and located to present a neat and symmetrical appearance.

E. Junction boxes, capped conduits and other electrical equipment above removable tile ceilings or above panels shall be suitably identified by small, inconspicuous adhesive-backed labels attached to the ceiling surface or the surface of the access panel. Labels shall be additionally secured with screws or rivets. Labels shall be white with 3/8" high black letter and shall be a manufactured item for that purpose.

2.6 CONCRETE WORK

A. Refer to Division 03 - Concrete for additional requirements and requirements.

B. Furnish and install all concrete work as shown and as required for all work included under this contract. Construct concrete forms and bases for equipment installed under this contract, where indicated, specified or recommended by the manufacturer. Concrete bases shall be constructed for all equipment that would normally be set on the floor, except

where shown or specified otherwise. Bases and forms shall be of suitable dimensions for all equipment or of sizes herein indicated.

C. Bases shall be reinforced with 6 x 6 x #10 gauge wire mesh and anchored through floor construction with 3/4" diameter bolts or rods. Anchor bolts for equipment shall be placed in base before equipment is set.

D. Concrete shall attain a minimum compressive strength of 3,000 psi at the age of 28 days. Tests shall be made by an approved laboratory if in the opinion of the Engineer the concrete is not satisfactory. All costs in connection with tests of concrete shall be borne by the Contractor.

E. All materials used for plain and reinforced concrete and the measuring, mixing, handling, placing and curing, shall conform to current specifications of the American Concrete Institute (ACI 304 and ACI 318). Cement shall be normal Portland cement, Type I or Type II, conforming to ASTM Designation C-150.

F. Aggregates shall consist of sand of approved quality, crushed stone, and washed gravel, conforming to ASTM Standard Specification Designation C-33, and shall be supplied from a source approved by the Architect. The maximum size of the aggregate shall be no larger than 1/5 of the narrowest dimensions between forms of the members for which the concrete is to be used, no larger than 3/4 of the minimum clear spacing between reinforcing bars. All water for concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

G. Slag in any form will <u>not</u> be permitted as an aggregate.

H. Proportions shall be in accordance with American Concrete Institute Standard "Recommended Practice for the Design of Concrete Mixes ACI 211.1".

I. Metal reinforcement shall be deformed steel bars or cold-drawn steel wire, or fabricated forms of these materials, as required by the drawings, or the specifications, or both. All bars shall be deformed, intermediate grade, new billet steel. These materials shall conform in quality to Standard Specifications of the American Society for Testing Materials of the following applicable titles and serial designations:

1. Bars
   - a) Billet-Steel Bars for Concrete Reinforcement: A615
   - b) Rail-Steel Bars for Concrete Reinforcement: A616
2. Wire
   - a) Cold-Drawn Steel Wire for Concrete Reinforcement A82
3. Fabricated Materials
   - a) Fabricated Steel Bar or Rod Mats for Concrete Reinforcement A184
   - b) Welded Steel Wire Fabric for Concrete Reinforcement A185
4. Refer to Division 05 – Metals for additional information and requirements.

J. Forms shall be of steel or wood and shall conform to the shape, lines, grades and dimensions of the concrete as required. They shall be sufficiently tight to prevent leakage

of mortar, and shall be properly braced and tied together so as to maintain the desired position and shape during and after placing concrete. Forms shall be removed in such a manner as to assure the complete safety of the structure. All exposed corners or edges shall be chamfered 1". All burrs, fins, irregularities of forming, or spillage, shall be removed and the surface float- or trowel-finished to a smooth, straight surface.

K. Where required, concrete shall be integrally waterproofed with Aquabar, or equal additive, as approved by the Engineer.

L. Where required, water stops of plastic as manufactured by Ryerson, or equal as approved by the Engineer, shall be installed in all concrete joints and between pours.

M. Provide concrete pads for all machinery or equipment mounted on grade outside the building (maximum total load of 10,000 pounds). Pads shall be a minimum of 6" thick with minimum 42" frost walls and 6 x 6 #6 wire mesh embedded in the concrete. Pads shall extend a minimum of 6" beyond the equipment in all directions, with the top 2" above surrounding grade. Chamfer top edges 1".

N. Provide concrete pads for all machinery or equipment mounted on grade outside the building (minimum total load of 10,000 pounds).Pads shall be a minimum of 8" thick with minimum 42" frost walls and #4 bars on 12" centers mesh embedded in the concrete. Pads shall extend a minimum of 6" beyond the equipment in all directions, with the top 2" above surrounding grade. Chamfer top edges 1".

O. All concrete work shall be constructed subject to the approval of the Architect.

2.7 EXCAVATION, BACKFILLING, AND SHORING

A. Refer to Division 01 – General Requirements and Division 32 – Earthwork.

3 EXECUTION

3.1 GENERAL INSTALLATION

A. All work shall be installed in a neat and workmanlike manner by craftsmen experienced in the trade involved and shall be acceptable to the Engineer. All details of installation shall be mechanically and electrically correct. All materials and equipment shall be new, and without imperfections or blemishes, unless otherwise noted.

1. Only qualified personnel familiar with proper voltage equipment shall perform work covered by this Division of the Specifications.

B. Before ordering any material or doing any work, the Contractor shall verify all measurements at the site and shall be responsible for the correctness of same. No compensation will be allowed on account of difference between actual dimensions and measurements and those indicated on the drawings. Any difference, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

C. This specification includes under each item all labor, material and equipment necessary to properly install complete, adjust, and place in operating condition, satisfactory to the Engineer, the several branches of work described herein. This shall include all necessary

interconnections between the several branches of work described herein, and connections to work under other sections of specifications and other contractors.

D. All items of labor, material or equipment not described in detail by specifications or drawings, but which are incidental to or necessary for complete installation and proper operation of several branches of work described herein, or reasonably implied in connection therewith, shall be furnished and/or installed as if called for in detail by drawings or specifications.

E. Follow all safety requirements as required by Code, including but not limited to those listed below:

1. Printed instructions shipped with the equipment.
2. Code-required and/or industry-accepted practices.
3. Electrical safety guidelines and practices.

F. The drawings are generally indicative of the work required and shall be followed as closely as circumstances will permit, however they do not indicate all bends, fittings, boxes and accessories which may be required. The Contractor shall carefully investigate structural and finish conditions affecting work and arrange work accordingly, furnishing such fittings, accessories, etc., required to meet such conditions. Contractor will be held responsible for proper installation of materials and equipment to the true intent and meaning of contract documents.

G. Carefully examine all contract documents, including those of all other trades; layout, plan and execute electrical work so as not to delay or interfere with the work of other trades. Obtain in writing from contractors of other trades such data as is necessary for proper coordination of the work.

H. Lay out work from dimensions of architectural and structural drawings and actual dimensions taken at the site; and from the approved dimensions of equipment being installed. Layouts in general shall <u>not</u> be scaled from electrical and/or mechanical drawings, but in congested areas in particular. No extra compensation will be allowed on account of difference between actual dimensions and measurements and those indicated on the drawings. Any difference, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

I. Coordinate locations of luminaires, conduit, wire, wiring devices, equipment, etc. to be clear of windows, doors, openings, diffusers, return grilles, sprinklers and other services and utilities. This Contractor shall be held responsible to coordinate his work with that of all other trades so that all work may proceed in an orderly manner and conflicts and delays may be avoided. Where drawings indicate special space allocation for different contracts, contractors shall rigidly adhere to the sequence of installation designated by the Engineer or required to allow all trades to work their equipment or materials into place and in respective order. Special attention shall be paid to work under the floor slabs, above ceilings and in locations otherwise concealed. All work shall be thoroughly tested before being closed in.

J. Secure dimensions of all recessed lighting fixtures; wiring devices and similar outlets; and other equipment in general, immediately upon the award of the Contract. Work closely with the General, HVAC, Plumbing and/or other Contractors and provide to them the necessary information and dimensions so that there will be no interference between piping,

duct work, structural steel, furring channels, etc. and recessed lighting fixtures or other electrical equipment.

K. Where outlets in ceiling construction occur in beams instead of in center, move outlets to center. Architect's final approval, however, is required prior to any such relocation. In case interference or fouling results, the Architect shall decide which is to be relocated, regardless of which is first installed.

L. Where required and as necessary, firmly support and secure all materials and equipment installed under this Contract to the building construction.

M. Determine the location and size of chase(s) and opening(s) necessary for proper installation of electrical work, sufficiently in advance and have same provided during erection of the work in which the chases and openings are required. This contractor shall furnish and set sleeves, hangers, and anchors, and shall be responsible for their proper and permanent location.

N. In cases where cutting of new building construction is necessary due to failure of this contractor to set proper sleeves or inserts, or to properly coordinate openings and chases required in said construction, such cutting shall be done and repaired to match the original condition of the work by this contractor and for no additional compensation.

O. Points of connection and termination of work under this specification are shown or noted on the drawings and/or stated within the specification; in case of doubt as to such points, the Engineer's decision shall be final.

P. Luminaires, conduit, wire, wiring devices and other electrical work shall be installed so as to preserve access to items that are intended to be accessible (i.e. cabinet doors, valves, filters, accessories, etc.), both those furnished under this specification and those furnished under other specifications. Clearances shall be provided on all sides of equipment as required for proper maintenance purposes, recommended by the equipment manufacturer, required by the National Electrical Code or required by other applicable codes.

Q. Follow manufacturer's published recommendations for installation methods not otherwise specified.

R. Furnish the services of manufacturer's representatives for each piece of major equipment furnished under these contract documents. The amount of factory service provided by the contractor shall be as normally recommended and furnished by the various equipment manufacturers unless specified otherwise.

S. Testing of equipment shall be made under the direct supervision of competent authorized service representatives. Any and all expenses incurred by equipment manufacturers' representatives shall be borne by the contractor.

T. Seal all openings left in building construction by the installation of work specified under this section. Sealing shall be performed in accordance with "Cutting and Patching" section specified herein and as directed by the Architect.

U. Where the vapor barrier of any insulation is broken due to the installation of conduit and equipment, properly repair all insulation and seal all openings with vapor barrier covering and vapor barrier adhesive of type installed with the insulation.

V. Upon completion of the work, all remaining waste materials and rubbish resulting from the contract work shall be removed from the building and premises.

W. Should job conditions or specified requirements conflict with manufacturer's instructions, consult the Engineer for clarification. Do not proceed with work without clear instructions.

X. The Contractor and his subcontractors shall satisfactorily complete the systems so that they are functional and operating to the satisfaction of the Engineer. All systems, their controls and their sequencing must be demonstrated to the satisfaction of the Engineer.

Y. Field Adjustments: Adjust relay and protective device settings according to recommended settings provided by the coordination study. Make minor modifications required to equipment for conformance with short circuit and protective device studies; notify owner in writing of any major equipment modifications which may be required prior to proceeding.

Z. Arc Flash Warning Labels: Affix warning labels to electrical distribution equipment in accordance with paragraph 1.20.

3.2 ELECTRIC SERVICE

A. Provide secondary electric duct bank(s) as indicated on the drawings, in accordance with these specifications and as further specified in Section 260533 – Raceway and Conduit for Electrical Systems.

B. Underground secondary conduits shall be PVC (schedule 40) from the main switchboard to new panels. Empty conduits shall be furnished and installed in the encasement as shown on the drawings; spare conduits shall be capped or plugged within each building as required. Equip spare conduits with nylon pull line.

C. All cables shall be identified by permanent plastic identification tags securely fastened to each cable at the switchboard and at the new panels. The tags shall designate the phase, voltage, and size of cable.

D. All ground bus, cable, terminals, rods, clamps, etc., shall be furnished and installed and grounding within the building shall be as per the latest edition of the National Electrical Code.

3.3 TELECOMMUNICATION SERVICES

A. Verify all service information herein or shown on the drawings. This contractor shall be responsible for the coordination and installation of required telecommunication service(s) as indicated by the drawings and directed by the Owner, complete in every detail and incorporating all labor, items and costs required by written instructions.

B. Provide site/building access conduit(s) or duct bank(s) as indicated on the drawings, in accordance with these specifications, as required by the Telecommunications Utility Company(s), and as further specified in Section 260533 – Raceway and Conduit for Electrical Systems.

C. Underground site/access conduits for telecommunication service(s) shall be PVC (schedule 40) from the utility termination point(s) to the main telecommunication room(s) or demarcation point(s) on/within the building, as indicated on the drawings. Empty conduit(s) shall be provided as indicated on the drawings; cap or plug conduits within building and at utility termination point(s). Install a nylon pull line in each telecommunications access pathway.

3.4 EXISTING BUILDING EQUIPMENT

A. Disconnect and remove existing equipment and services presently installed within the existing building as noted on the plans or as required to accommodate the renovations. All other existing equipment shall remain intact. If new equipment such as receptacles, light fixtures, etc. is to be installed where an existing device is located, the existing outlet box may be reused. Coordinate all demolition work with the Owner and General Contractor.

B. All existing building equipment to be removed that would be of some value to the Owner, such as light fixtures, time clocks, safety switches, panelboards, etc., shall be removed by this contractor and turned over to the Owner for storage.

C. It is this Contractor's responsibility to pay disposal fees for equipment removed. Equipment shall be disposed of in accordance with governing environmental regulations (i.e. ballasts, lamps, transformers, batteries, etc.).

D. New circuit breakers for existing switchboards, panelboards or loadcenters shall match the existing circuit breaker type, manufacturer, and AIC rating. Circuit breakers that are added into existing equipment shall be new, unless noted on the drawings as existing to be relocated and/or reused; and shall be purchased from an authorized manufacturer's distributor. Proof of the purchase may be requested by the engineer in the form an authorized distributor's invoice. Purchase of used, reconditioned, or brokered circuit breakers shall not be approved.

3.5 REMOVAL OF EXISTING CIRCUITS

A. Where it is noted for switches, receptacles, fixtures or other electrical devices to be disconnected and removed; it shall be understood that all associated wiring, junction boxes, etc. (not required to remain, due to continuity or other necessity) shall be removed in their entirety.

3.6 EXTENSION OF EXISTING CIRCUITS

A. Where existing equipment is indicated as being relocated and a circuit connection is not shown or noted, this Contractor shall extend and connect the existing circuit required. In areas where the general construction work interrupts the continuity of a circuit this Contractor shall relocate portion of the circuit required.

3.7 EQUIPMENT CONNECTIONS

A. Terminate and make final connections to circuits shown on the drawings for each piece of equipment requiring electric service.

B. The drawings show generally the location of electric service to each piece of equipment. However, this contractor shall secure detailed shop drawings showing dimensioned locations for electric service to each piece of equipment from various contractors supplying such equipment prior to roughing-in.

C. This contractor will be required to relocate any misplaced outlet at his own expense if he fails to secure detailed shop drawings prior to roughing-in for equipment.

3.8 EQUIPMENT DISCONNECT SWITCHES

A. Unless otherwise noted on the electrical drawings, disconnect switches for each new piece of equipment furnished under the HVAC and/or Plumbing contract(s) shall be furnished by the respective contractor(s) and delivered to the Electrical contractor for installation. The Electrical contractor shall provide all final electrical wiring/connections to disconnect switches and aforementioned HVAC and Plumbing equipment.

B. Unless otherwise noted on the electrical drawings, disconnect switches for each new piece of equipment furnished by the General Contractor shall be provided by the Electrical Contractor. The Electrical Contractor shall provide all final electrical wiring/connections to disconnect switches and the aforementioned equipment.

3.9 MOTOR CONTROL WIRING

A. All motor driven equipment specified under the Mechanical contracts (Divisions 21 thru 25 of the specifications) shall be furnished and installed under the respective contract(s). All power wiring to and through the equipment shall be provided under the Electrical contract.

B. Install circuits for each piece of motor driven and electrically heated equipment. Extend power wiring to and through disconnect switches, magnetic starters, step controllers, motor drives, etc. and make all required final connections for power to motors and electric heating elements.

C. This Contractor will be responsible for the direction of rotation of all motors and shall make all final connections to all electrically operated starters and equipment. All wiring between remote push button stations and starters, which are furnished by others, shall be provided by the Electrical Contractor unless otherwise specified.

D. Motor starters, step controllers and drives for equipment supplied under the Mechanical contracts (Divisions 21 thru 25) shall be furnished by the respective contractor(s) and installed by the Electrical Contractor unless otherwise specified or denoted on the drawings.

3.10 AUTOMATIC TEMPERATURE CONTROL (ATC) WIRING

A. Furnish a duplex receptacle adjacent to the main ATC Panel where shown on the drawings. All ATC wiring will be furnished and installed by the ATC Contractor.

3.11 REFRIGERATION COMPRESSOR CONTROL WIRING

A. All interconnecting control wiring to the refrigeration compressors and starters will be furnished and installed by others.

3.12 SPLICES

A. Splices shall be made with approved type solderless connectors of the insulated type. However, at locations where the non-insulated type are used, they shall be covered with rubber and friction tape to the same thickness as the original insulation of the wire used.

3.13 BALANCING

A. Each system of feeder and branch circuits for power and lighting shall be connected to panelboard buses in such a manner that loads connected thereto will be balanced on all phases as closely as practicable. Should there be any unfavorable condition of balance on any part of the electrical system, the Electrical Contractor shall make changes to the electrical system that may be required by the Architect to remedy the unbalanced condition.

1. Should there be an unbalance on existing equipment, not included under this contract, the contractor shall report the unbalance condition to the Architect and Owner so that the condition may be corrected by the Owner under a separate contract.

B. Before final acceptance, submit readings of all phase legs at each panel with all lighting and power circuits "on". All conductors for the system shall be connected in strict accordance with the requirements of the National Electrical Code.

3.14 ELEVATOR LIGHTING AND EQUIPMENT

A. Provide lighting fixture(s) and local control switch in elevator pit as detailed on the drawings. Connect to circuit indicated on the drawings. Coordinate device locations with elevator equipment installer.

B. Provide a weatherproof GFCI receptacle in the elevator pit for maintenance.

C. Provide connection to sump pump and/or controller (no GFCI); coordinate device location with Plumbing Contractor.

D. Verify all dimensions and clearances in the field prior to mounting equipment, devices or other components of the electrical work and prior to any official inspection. Coordinate all clearances with other trades components, devices and other equipment throughout each phase of the project.

E. When sprinklers are installed in the elevator hoistway, wiring less than 48” above elevator pit floor shall be suitable for use in Wet Locations. Electrical equipment less than 48” above pit floor shall be weatherproof (NEMA 4).

F. Only such items, wiring and equipment as directly pertaining to the elevator shall be installed in (or run through) elevator machine rooms and hoistways.

3.15 PIPE CURBS; EQUIPMENT SUPPORTS; AND FLASHING

A. Coordinate installation of curbs, equipment supports, and flashing with the roofing work. Refer to Architectural drawings for related details.

B. Minimum curb and support height shall be 12 inches.

C. Flash and counter flash where electrical conduit and equipment passes through weather or waterproofed walls, floors and roofs.

3.16 FIRESTOPPING

A. Install sleeves and firestopping at all openings in fire and smoke rated barriers around wiring and equipment installed under this contract to maintain the rating of the barrier.

B. Firestopping materials shall maintain the fire rating of the barrier in accordance with the requirements of NFPA, the local governing bodies and other applicable codes.

C. Refer to the Architectural drawings for locations and ratings of all fire and smoke rated barriers.

3.17 ELECTRICAL IDENTIFICATION

A. Coordinate identification systems with Owner’s existing systems or master systems before ordering material.

B. Clean all surfaces in accordance with manufacturer's recommendations before installing identification. Identification shall not be installed before final painting is complete.

C. Nameplates:

1. Install interior nameplates with permanent adhesive, screws, bolts or rivets.
2. Install exterior nameplates with screws, bolts or rivets.
3. Identify components such as switchboards, panelboards, safety switches, junction boxes, breakers, terminal cabinets, etc.
4. Equipment shall be identified by title as taken from the plans in a position that is clearly visible. Nameplate nomenclature shall be verified with building owner and Engineer prior to installation.
5. Identify the location of equipment concealed above a ceiling with a color-coded thumbtack in ceiling.

3.18 EXCAVATION AND BACKFILLING

A. Perform excavation of necessary widths and to depths required for the installation of manholes, box pads, concrete foundation slabs, for the installation of underground duct banks, and for the installation of other equipment and materials as shown on the drawings and herein specified.

B. Final grading, finishing, paving and seeding at all excavated areas shall be included under this contract, except where new surfaces are being provided as a part of the site work under the General Contract. The Electrical Contractor will be responsible for all backfilling and paving of roadways, sidewalks and other paved areas associated with this contract. All surfaces shall be restored to the satisfaction of the Architect.

C. Prior to submitting a bid price and prior to any work, the Electrical Contractor shall familiarize himself with local ordinances and amendments and shall contact the appropriate authorities to obtain all regulations and requirements that must be followed. Secure any and all necessary permits and/or approvals before the start of any work.

D. Conform to Act No. 287 of the General Assembly of the Commonwealth of Pennsylvania that was enacted to protect the public health and safety.

E. The bottoms of all excavations shall be properly leveled off and concrete placed on undisturbed soil. All loose materials shall be removed and the excavations shall be brought into approved condition to receive concrete or other material. No earth filling shall be allowed under any bases or slabs. All excavation shall be carried down to firm formation. However, if additional depths are required to reach firm earth, the extra excavation and materials required to perform the work shall be done at no extra cost to the Owner. If, through an error on the part of the contractor, any part of the excavation is carried below the depth indicated or required for the work, the contractor shall maintain the excavation and shall start concrete from the excavated level, and no extra compensation will be considered. Excavate and pour concrete only on the basis of approved shop drawings. Excavation below footings shall be filled with concrete as directed by the Architect.

F. Notify the Architect as soon as excavations are completed, in order that the bearing quality of the bottoms may be inspected before concrete is poured, or before formwork is erected. Concrete shall be poured as soon as weather conditions permit after excavation is completed and inspected. In case bottoms of excavations become wet and soft, all soft material shall be removed and the concrete poured to the required extra depth, at no extra cost to the Owner.

G. Minimum cover for the various lines shall be not less than indicated on the drawings, but not less than local regulations and practice. Generally, piping shall be installed with not less than 3'-0" cover.

H. The width of all trenches shall be not less than widths shown on the drawings or required to install piping and materials.

I. The excavation shall be kept safe at all times. Shoring and sheathing shall be used when necessary. The excavation shall be kept free of water at all times. Additional shoring and sheathing may be ordered at any time to safeguard the work. Shoring and sheathing shall be provided in strict accordance with all applicable State, county and local ordinances and regulations.

J. All excess excavated materials shall be disposed of as directed by the Architect. The number of points at which the contractor will be permitted to work and length of open trenches that will be permitted will be governed by the Architect.

K. No existing asphalt or concrete paving shall be buried or otherwise disposed of on the site. It shall be disposed of off-site, by the contractor, in a manner consistent with applicable laws and regulations.

L. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns, and guards shall be placed and maintained during

the progress of construction, and until it is safe for traffic use. Rules and regulations of the local authorities respecting safety provisions will be observed.

M. Adequate protection shall be provided for all new or existing structures, services, or utilities encountered in the excavation. The protection shall include bracing, sheathing, supports, etc., as required to maintain grade and alignment and to provide proper mechanical strength. Any structures, services, or utilities damaged by the work of the contractor shall be promptly repaired and replaced in same condition as they originally were prior to such damage.

N. Any existing services, utilities or other obstructions that are no longer required shall be removed where encountered during the excavation.

O. Excavation shall be conducted in a manner to cause the least interruption of traffic. Where traffic must cross open trenches, the contractor shall provide bridges suitable for the traffic involved.

P. The proposal shall include all excavation that may be necessary to complete the project, including any rock that may be encountered. No blasting of any kind will be permitted on the interior or exterior of the building.

Q. After the pipe or equipment has been laid, tested, inspected and concrete has been poured, cured and inspected, the excavation shall be backfilled by the contractor with the best carefully selected materials free from stones, large pebbles, hard lumps or frozen earth. The backfilling shall be placed in horizontal layers not to exceed 6" in thickness and each layer shall be thoroughly consolidated and compressed with pneumatic rammers. No backfilling shall be done until all undermined earth has been broken down and the sides of the excavation made vertical or inclined outward.

R. New backfill shall be obtained on the site where necessary and where directed by the Architect; if necessary, backfill shall be hauled from off-site locations at no additional cost to the Owner.

S. Restore the surfaces of all excavations to their original condition. This shall include existing or new paved or unpaved streets, parking areas, driveways, sidewalks, and turf. Existing trees, shrubs, or turf damaged under this contract shall be replaced to the satisfaction of the Owner and the Architect.

T. As the work progresses, record on the drawings all changes and deviations from the contract drawings. Measurements shall include elevations and sufficient offset measurements from building to definitely locate all equipment and underground lines. Two prints of the marked drawings shall be delivered to the Architect before final acceptance.

U. Any settling, deterioration or washing out of earth or repaired surfaces after the initial installation shall be corrected by this contractor.

3.19 MOUNTING HEIGHTS

A. In addition to careful review of the electrical drawings, this Contractor shall refer to all applicable details, plans, etc. of the architectural drawings for exact positioning of

electrical, telephone, data, television, video, etc. outlets prior to installations. Unless otherwise specifically instructed, centerline-mounting heights of outlets and other equipment shall be located as follows:

1. Local Lighting Control Switches: Locate all outlets for single or gang switches 44" above finish floor on strike side of door. If this location is such that it places the switch group partly in tiles or other finishes, the outlet shall be lowered sufficiently to bring the plate entirely on a flat surface (verify with Architect before lowering outlet).
2. Duplex Convenience Outlets: 18" above finished floor except as otherwise noted. Coordinate receptacle locations for wall mounted televisions with Architectural details.
3. Safety Switches: 48” above finished floor to the top of the operating mechanism, except as otherwise noted.
4. Suspended Fixtures: As shown on drawings, as scheduled or as directed by the Architect.
5. Outlets Above Countertops: 8" above top of counter without backsplash, or 6" above top edge of backsplash, except as otherwise noted.
6. Blank Outlets: Coordinate location with served equipment manufacturers shop drawing and installation details for service connection point of access except as otherwise noted.

B. Where exact location, mounting height or orientation for a device, fixture, outlet or other electrical equipment may be unclear, request clarification from the Architect prior to rough in or installation.

END OF SECTION

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wires and cables and associated connectors, splices and terminations for power, lighting, control and related systems rated 600 V and less. Refer to individual system sections for special wire and cable specifications. Types of wires and cables in this section include the following:

   a) Building Wire and Cable (600 Volt and Less)

   b) Metal-Clad (MC) Cable (Limited Usage)

1.2 QUALITY ASSURANCE

A. The wires and cables, including all associated connectors, splices and terminations shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)/Insulated Cable Engineers Association (ICEA)
3. Institute of Electrical and Electronics Engineers (IEEE)
4. Underwriters Laboratory (UL) listed and labeled.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. AFC Cable Systems
2. Southwire
3. American Insulated Wire Corporation
4. General Cable Company

2.2 BUILDING WIRES AND CABLES (600 V and Less)

A. Provide wires and cables of sizes indicated on the drawings and suitable for the temperature, conditions, and location where installed.

B. Conductor material shall be 98 percent conductivity copper rated at 600 V.

C. Conductors in sizes up to and including #10 AWG shall be furnished solid. Size #8 AWG and larger shall be stranded.

D. Insulation shall be type THHN/THWN, THW or XHHW as appropriate for the locations and space temperature where installed.

E. Utilize type THWN wire for all panel feeders, underground circuits (whether feeders or branch circuits), and in exterior installations above grade.

F. Factory-applied nylon or PVC external jacketed wires and cables shall be utilized in all locations where conduit or duct is installed underground, under slabs on grade, in damp/wet locations, in pulls over 100-feet in length or in pulls that contain more than three equivalent 90 degree bends.

G. Control wires and signal system cables shall be plenum rated unless installed in conduit for their entire length.

2.3 METAL-CLAD (MC) CABLE (LIMITED USAGE)

A. Use of MC cable will not be permitted except at the following dry locations:

1. Final flexible connections (6ft maximum length) to recessed lighting fixtures and/or ceiling mounted devices.

2. Extension of the building conduit and junction box system for service to outlets installed in existing partitions and wall surfaces to eliminate cutting and patching of existing surfaces. Transition MC cabling to building wire and conduit in junction box located at nearest point above accessible ceiling.

B. Provide MC cables of sizes indicated on the drawings and suitable for the temperature, conditions and location where installed. MC cable not allowed for use in areas other than dry locations.

C. Conductor material shall be 98 percent conductivity copper rated at 600 V.

D. Insulation shall be type THHN.

E. Factory-applied PVC external jacketed MC cables shall be used in all locations where cable is installed in damp/wet locations.

F. MC cable shall be constructed of galvanized steel armor, and provided with all necessary MC connectors and shall be in compliance with UL 1569 and NEC 330.

G. Multi-conductor cables shall be provided as indicated in panel schedules on contract drawings. Green copper ground wire shall be provided for all branch circuits.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 260500 and manufacturer’s recommendations.

B. All wiring shall be run in raceways in accordance with Section 260533 and the manufacturer’s recommendations, unless specifically noted otherwise.

C. Wire and cable supports shall be installed in accordance with requirements of Section 260529 and the National Electrical Code.

D. In general, wires and cables shall be installed as shown on the drawings. However, the drawings are diagrammatic and are not intended to show actual raceway routing or exact equipment location. Therefore, it is the responsibility of the Electrical Contractor to coordinate with other trades and account for actual field conditions.

E. Pull all conductors simultaneously where more than one is being installed in the same raceway. Great care shall be exercised in pulling wires into raceways so as not to damage insulation. UL listed pulling compounds or lubricants may be used, where necessary.

F. Conceal all cable in finished spaces. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible.

G. Conductors for branch power and lighting circuits shall not be smaller than #12 AWG. Pilot and control circuit conductors shall be not smaller than #14 AWG or as recommended by the control system/device manufacturer.

H. Switches shall not be connected to the neutral conductor.

I. For convenience in maintenance and testing, make full use of color-coded wire in all installations. Wire having a white insulation shall be used only for the neutral conductor. Wire having a green insulation shall be used only for the ground conductor.

J. Conductors shall be continuous from outlet to outlet and no splice shall be made except within outlet or junction boxes.

K. Splices located in wet locations indoors, or direct buried, in manholes, vaults and handholes outdoors shall utilize 3M cold shrink splices with compression cable connection, and be approved for wet locations.

L. Balance all circuits so as to provide as close an electrical balance as possible across the phase wires of the branch panels and the main distribution panel.

M. Identification:

1. All wires and cables shall be identified at each end and within pull boxes, junction boxes, manholes, cable vaults, etc., indicating circuit number and equipment or area served. Identification shall be attached to each cable. Underground site lighting circuit conductors shall be identified in all manholes and at each light standard or fixture.

2. Identification shall be constructed of plastic material permanently stamped with lettering of contrasting color. Plastic shall be of heavy thickness and attached to cable by nylon cord or other suitable attachment means. Submit samples of tag and attachment means for approval before purchase.

3.2 TESTS

A. Prior to energizing, check installed wires and cables with megohmmeter to determine insulation resistance levels to insure requirements are fulfilled.

B. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.

3.3 FIELD ADJUSTMENTS

A. Subsequent to wire and cable final connections and tests, energize circuits and demonstrate proper functioning.

END OF SECTION

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. General grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents.

1.2 QUALITY ASSURANCE

A. The grounding and bonding equipment, including all necessary accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Institute of Electrical and Electronics Engineers (IEEE)
4. Underwriters Laboratory (UL) listed and labeled.
5. American National Standards Institute/Telecommunications Industry Association/Electronics Industries Alliance (ANSI/TIA/EIA)-607, Grounding and Bonding

1.3 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of Section 260500 and General Conditions of Contract.

2 PRODUCTS

2.1 GENERAL DESCRIPTION

A. Provide an insulated full size green ground wire in the same conduit as the branch circuit or feeder wiring for all branch circuits and for all feeders.

1. Raceway/conduit systems shall NOT be relied upon as the sole grounding means.

B. All grounding and bonding connections shall be solderless except where indicated otherwise on the drawings or hereinafter. System grounding shall be performed in strict accordance with the NEC, particularly Article(s) 250 and 517 as applicable.

C. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.

D. It is essential and extremely important that the contractor familiarize himself thoroughly with all applicable codes prior to the installation of grounding system. All ground conductors, methods of installation, etc., shall be in accordance with Code requirements.

E. In particular, the Contractor's attention is called to Sections 250.50 and 250.52 of the NEC. Be aware that, in general, all concrete footers and foundations containing reinforcing steel, shall be considered as "Concrete Encased Electrodes" and MUST BE CONNECTED to the Ground Electrode System. Coordination between the installing electrician and the General Contractor will be necessary early on in the project so that proper arrangements are in place for bonding of rebar, prior to concrete pour. Verify quantity of rebar bonding point(s)/extent of bonding required with the local Electrical Inspector as part of this early coordination process.

1. Failure to ascertain specific requirements with the local Electrical Inspector or to coordinate installation of same with the General Contractor shall not constitute grounds for a change order.

2.2 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per the NEC.

B. All connection of ground conductors to ground rods, bus bars, rebar, structural members, pipes or fences, and splices of ground conductors, shall be made by exothermic welds except where otherwise noted. All connections to bar lugs shall be exothermic weld or compression type. Bolted type connection of ground conductors may only be made where terminal lugs or blocks have been furnished and installed in equipment by the manufacturer. The basis of design for exothermic welds shall be the "Cadweld" process manufactured by Erico.

C. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be solid bare copper wire.

D. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

2.3 GROUND RODS

A. Ground rods shall be copper-bonded steel. The copper-bonded ground rods shall have an electrolytic coating of copper deposited over a layer of nickel. This process shall ensure a long lasting, molecular bond between the copper layer and the steel core. Copper sheathed, steel core ground rods will not be acceptable.

B. Ground rods shall be of sufficient lengths to penetrate at least 6" in permanent moist earth but not less than 8'-0" in length with a minimum diameter of 5/8" and 10 mils of copper.

C. Quantity of rods shall be not less than as indicated on the drawings or as required to obtain the specified ground resistance hereinafter.

2.4 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL standards and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 260500 and manufacturer's recommendations.

3.2 GENERAL

A. Ground electrical systems and equipment in accordance with requirements of the National Electrical Code and as indicated on the drawings.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
3. Isolation transformers and isolated power systems shall not be system grounded.

C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items shall be bonded and grounded.

3.3 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

B. Arrange for observation of all such connections by the local Electrical Inspector prior to connections being covered or becoming otherwise inaccessible.

3.4 GROUNDING CONNECTIONS SUBJECT TO MECHANICAL INJURY

A. Where grounding conductors are subject to mechanical injury, they shall be protected by encasement in concrete or installed in a rigid metallic raceway.

3.5 SECONDARY EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Service entrance ground counterpoise system: Bond to the ground bus in the service equipment.

C. Foundations and Footers:

1. Bond rebar installed in foundations and footers and connect to the Grounding Electrode System (service equipment ground bus) as required by the NEC and the local Electrical Inspector.

D. Metallic Piping and Building Steel:

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467. Ground fittings at water system connections shall be made by exothermic welds.

F. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the inside of enclosure with lugs for connecting the various grounding conductors.

G. Panelboards:

1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

H. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

I. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits (interior and exterior circuits).

J. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

K. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

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

M. Ground lighting fixtures to the equipment grounding conductor of the wiring system.

N. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.6 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.7 TELECOMMUNICATIONS SYSTEM

A. Perform installation of telecom system grounding and bonding infrastructure in accordance with applicable codes, ANSI/TIA/EIA-607, latest edition of NEC and the requirements contained herewithin.

B. Install electrotin plated copper telecom grounding busbar on 2” high, insulated standoffs in telecom service entrance room, telecom equipment room and each telecom closet. Busbars shall be predrilled with rows of holes in accordance with NEMA standards and the type of connectors to be used. Minimum busbar size shall be ¼” thick x 4” high x variable length (sized in accordance with immediate termination requirements and for 50% future growth). Minimum height of busbars for telecom closets shall be 2” high.

C. Telecom bonding conductors shall be insulated no. 4 AWG copper with listed two hole compression or exothermic welded connectors (unless otherwise noted). Insulation shall be green with blue tracer.

D. Bond telecom grounding busbar located in telecom service entrance room to electric service entrance equipment ground bus.

E. Bond together telecom grounding busbars located throughout entire building.

F. Bond telecom equipment, frames, voltage protectors, isolation gaps, telecom backbone cable shields, building structural steel, metallic raceways for telecom cables, etc., in the telecom service entrance room, telecom equipment room and each telecom closet to the room telecom grounding busbar (TGB). Where a panelboard serving telecom equipment is located in the same room as a TGB, that panelboard’s enclosure shall be bonded to the TGB.

3.8 GROUND RESISTANCE

A. The resistance of ground for the entire power system grounding system shall not exceed 25 ohms under normal dry conditions. Tests of grounding resistance shall not be made within 24 hours after a rainfall. If after testing the system it is found that the resistance exceeds 25 ohms, the Electrical Contractor shall install the necessary number of ground rods to reduce the resistance to less than 25 ohms.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Services at power company interface points shall comply with the power company ground resistance and installation requirements.

D. Below-grade connections shall be visually inspected by the owner or engineer prior to backfilling. Notify the owner or engineer 24 hours before the connections are ready for inspection.

3.9 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth.

B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with compression type ground connectors.

C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

END OF SECTION

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.2 QUALITY ASSURANCE

A. The supporting devices, including all necessary components and associated accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Underwriters Laboratory (UL) listed and labeled.

B. Comply with the current governing building codes regarding restraints due to earthquake loads.

2 PRODUCTS

2.1 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.2 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:

1. Expansion Anchors: Carbon steel wedge or sleeve type.
2. Toggle Bolts: All steel springhead type.
3. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. U-Channel Systems: Min. 16-gage steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

2.3 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:

a) Up to 6-inch: 16-gage.

b) Over 6-inch: 14-gage.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

3 EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently from the primary building structure in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway and Cable Supports: Comply with the NEC and the following requirements:

1. Support all cables at intervals not exceeding 6 feet.

2. The use of wire ties for raceway and component attachment, or for permanent attachment of cables, is <u>not</u> permitted.

3. Conform to manufacturer's recommendations for selection and installation of supports.

4. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four.

a) Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.

5. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

6. Support parallel runs of horizontal raceways together on trapeze-type hangers.

7. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

8. Space supports for raceways in accordance with the NEC.

9. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

10. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

D. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

E. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

F. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant or system in gaps between sleeves and enclosed conduits and cables in accordance with “Firestopping” requirements of Section 260500.

G. Conduit Seals: Install seals for conduit penetrations of exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

H. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

END OF SECTION

SECTION 260533 – RACEWAY AND CONDUIT FOR ELECTRICAL SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Raceways for electrical wiring; complete, including all necessary elbows, couplings, fittings and associated accessories. Types of raceways in this section include the following:

   a) Rigid Metal Conduit

   b) Electrical Metallic Tubing

   c) Flexible Metal Conduit

   d) Liquidtight Flexible Metal Conduit

   e) Rigid Nonmetallic Conduit

   f) Conduit Bodies

   g) Wireway

1.2 QUALITY ASSURANCE

A. The raceways, including all necessary elbows, couplings, fittings and associated accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)

2. National Electrical Manufacturers Association (NEMA)

3. Underwriters Laboratory (UL) listed and labeled.

1.3 RECORD DOCUMENTS

A. Document exact routing of all “feeders” (including notation of conduit rises, conduit drops and locations of junction boxes) on final set of As-Built drawings (i.e. panelboard feeders, transformers feeders, switchboard feeders, elevator feeders, feeders for large pieces of HVAC equipment, etc.).

1.4 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of Section 260500 and General Conditions of Contract for the following equipment:

1. All Conduit Types (utilized on the project)

2. Conduit Bodies

3. Wireway

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Conduit:
   a) Allied Tube & Conduit
   b) Wheatland Tube Company
   c) Eastern Wire & Conduit
   d) Western Tube & Conduit
   e) Cantex
2. Conduit Bodies:
   a) Thomas & Betts
   b) Oz-Gedney
   c) Crouse-Hinds
3. Wireway:
   a) Hoffman
   b) Square D
   c) Hubbell-Wiegmann

2.2 RIGID METAL CONDUIT

A. Rigid metal conduit (RGS) shall be made of zinc-coated steel piping complying with ANSI C80.1 and UL 6. It shall be of sufficient weight and toughness to withstand cracking and peeling during bending. Galvanizing shall consist of a coating of zinc of uniform thickness applied to inside and outside of walls by either electrolytic or hot metal dip process.

B. Each piece of conduit shall be straight, free from blisters and other defects, cut square and taper reamed and shall be furnished in 10 foot lengths, threaded at each end. Couplings shall be supplied at one end and protection for the other end. All threads shall be cleanly cut. Each length shall bear the Underwriters' Label.

C. Fittings:

1. Comply with NEMA FB 2.10-2007, Selection and Installation Guidelines for Fittings for Use With Non-Flexible Metallic Conduit or Tubing.
2. Zinc-coated steel, if size 2-1/2 inches or less, and zinc-coated malleable iron if larger. Dependent upon application, fittings shall be rated rain tight or concrete tight when applicable.

2.3 ELECTRICAL METALLIC TUBING

A. Electrical Metallic Tubing shall be the same general construction as rigid metal conduit specified above, except for wall thickness and fittings, which shall be zinc-coated steel compression type for all sizes. Set screw type fittings will not be acceptable.

B. Electrical Metallic Tubing shall be constructed in compliance with ANSI C80.3 and UL 797.

2.4 FLEXIBLE METAL CONDUIT

A. Flexible Metal Conduit shall be made of helically wound, formed, interlocked zinc-coated steel strip complying with UL 1. It shall be of sufficient weight and toughness to withstand damage during bending.

B. Cut ends shall be trimmed or otherwise finished to remove rough edges.

C. Fittings shall be constructed of zinc-coated steel, if size 3/4 inch, and zinc-coated malleable iron if larger. Fittings shall be squeeze/clamp type with deep slotted machine screw for securing conduit.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Liquidtight Flexible Metal Conduit shall consist of an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible zinc-coated steel core complying with UL 360. It shall be of sufficient weight and toughness to withstand damage during bending.

B. Fittings shall be constructed of zinc-coated steel, if size 1 inch or less, and zinc-coated malleable iron if larger. Fittings shall be compression type with steel ferrule and neoprene gasket sealing rings.

2.6 RIGID NONMETALLIC CONDUIT

A. Rigid Nonmetallic Conduit shall be constructed of Schedule 40 polyvinyl chloride (PVC), sunlight resistant, rated for use with 90 degree Celsius conductors and in compliance with UL 651.

B. Fittings and cement designed especially for this type of conduit shall be used throughout. Conduit shall be firmly anchored in trenches. Wherever possible, offset fittings shall be avoided and conduit shall be swept to radius and bent as required.

2.7 CONDUIT BODIES

A. General: Provide types, shapes and sizes as required for the application. Conduit Bodies shall have threaded hubs and removable gasketed covers secured with zinc-coated steel screws.

B. Metallic Conduit and Tubing: Conduit Bodies shall be constructed of zinc-coated iron.

C. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies suitable for the application and approved for use with the raceway.

2.8 WIREWAY

A. General: Furnish and install wireway of proper types, sizes and number of channels as shown on the drawings or required per the application and field conditions. Wireways and associated fittings shall be constructed in accordance with UL 870.

B. Covers shall be hinged, removable and capable of being reinstalled without tools. Provisions shall be included in the construction to allow screwing the hinged cover closed without the use of parts other than the standard lengths, fittings and connectors. It shall also be possible to seal the cover in a closed position with a sealing wire. Wireway shall be constructed with knockouts.

C. All sheet metal parts shall be provided with a rust inhibiting phosphatizing coating and gray baked enamel finish. All hardware shall be plated to prevent corrosion. All screws installed toward the inside shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage.

D. All connectors shall be slip-in type with self-retained mounting screws. All hangers shall be two-piece with hook together feature to permit preassembly of wireway and hanger bottom plate before hanging on preinstalled upper bracket.

E. Wireway shall be so installed that the hinged cover surface is in the vertical position to allow for easy accessibility to conductors and preclude the spilling of conductors when cover is opened.

F. All lengths, connectors and fittings shall be UL labeled and installed in accordance with the National Electrical Code and as shown on the drawings. UL listing of lengths without listing of connectors or fittings is not acceptable.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 260500 and manufacturer’s recommendations.

B. The entire conduit installation shall be concealed in the construction except that it may be run exposed in unfinished areas and mechanical rooms. Where un-plastered concrete slab ceilings occur, conduit shall be installed in ceiling slab. No exposed conduits will be permitted on finished walls or ceilings, unless otherwise noted.

C. Rigid metal conduit shall be furnished and installed for panel and service feeders, large motor feeders, below concrete slabs on grade, within walls or in "web" (void) of metal decking above grade. Conduits over 2 inches trade size shall be rigid metal conduit irrespective of use, unless otherwise noted.

D. Rigid metal conduit is permitted to be installed within concrete slabs, provided that both:

1. Minimum concrete slab thickness is 4 inches

2. Concrete slab provides not less than 2 inches cover over conduit.

E. Electrical metallic tubing may be utilized at all other locations as allowed by the NEC, except where subject to damage or otherwise specified.

F. Flexible Connections: Use short extension (maximum of 6 feet) of flexible metal conduit for connection to recessed or semi-recessed lighting fixtures; equipment subject to vibration, noise transmission, or movement; and for motors. If located in exterior, moist or humid locations; corrosive atmospheres; or where subject to water spray, dripping oil, grease or water then use liquidtight flexible metal conduit.

G. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, furnish and install removable threaded plugs flush with floor.

H. Do not install conduit in stone/cinder fill. However, where this is impracticable, utilize GRS conduit encased on all sides by not less than 2 inches of concrete.

I. Utilize fittings marked “Concrete-tight” or “Raintight” where conduit is intended for embedment in poured concrete. Utilize fittings marked “Raintight” or “Wet locations” where conduit is intended for installation underground, outdoors, or in wet locations. Threaded fittings shall be made up wrench tight.

J. Conduits shall be run as straight and direct as possible to limit number of bends or offsets to a minimum. Exposed conduits shall be installed with runs parallel or perpendicular to walls and ceilings, and with right angle turns utilizing conduit bodies or symmetrical bends. Exposed vertical conduit runs shall be run on the building walls or columns, where possible. Where switch and receptacle outlets occur in exposed runs, zinc-coated cast iron device boxes shall be used at these locations. Review all portions of exposed raceways in finished areas with the Architect prior to installation.

K. Not more than the equivalent of four (4) 90-degree bends will be allowed in any one run of conduit. Where more bends are necessary, a pull box shall be installed. All couplings shall be pulled up tight so as to provide an electrical bond throughout the entire conduit system.

L. No conduit smaller than 3/4 inch trade size shall be used in any part of the various systems, nor shall the conduit be smaller than size required by the NEC. Crowding wiring will not be permitted.

M. Conduit bends shall be of the large radius, machine-made, without kinks, flattening or crushing. Conduit may be bent by using an approved pipe bending machine or hickey.

N. Conduits installed directly under roof decking shall be installed a minimum distance of 1 1/2” below the roof deck.

O. Conduit ends shall be square cut and reamed to remove burrs. Cut EMT utilizing a hack saw or band saw; do not use roll-type tubing cutters. Conduit shall be installed in such a manner that wires may be removed and replaced at a later date.

P. Approved threaded couplings, such as the 3-piece coupling (Erickson) or suitable union, shall be used where construction requires the use of a union. Running threads will not be permitted. Expansion fittings shall be used where conduit crosses expansion joints.

Q. Where steel conduit is threaded in the field, the thread shall be coated with an approved electrically-conductive, corrosion-resistant compound. Coatings for this purpose, listed under UL category "FOIZ" are available; zinc-rich paint or other coatings acceptable to the AHJ may also be used.

R. Raceway supports shall be installed and supported in accordance with requirements of the National Electrical Code and specification section 260529. Raceways are permitted to be mounted directly to the building structure. Assure that supporting means and associated fasteners are compatible with the mounting surface from which they are supported. Raceways supports shall be installed only on conduit of the trade size indicated on the fitting (or smallest respective shipping container).

S. Each end of every conduit run terminating in a pressed steel box of any type shall be provided with a galvanized locknut and bushing inside and a locknut outside. All feeder conduits shall be provided with hardwood or fiber bushings at all junction boxes, panels, etc.

T. Do not rely upon locknuts to penetrate nonconductive coatings or finishes on enclosures. Such coatings shall be removed *in the locknut contact area only* prior to raceway assembly, to ensure continuity of ground path. Touch up bare areas as needed after fitting assembly.

U. Outlet, junction and pull boxes shall be securely anchored to structural members as required or indicated on the drawings and not dependent on conduit for support. If structural members are not provided at locations of boxes for support, this contractor shall furnish and install same.

V. A separation of 6 inches shall be maintained between all conduit and hot water, steam lines and flues in the building. Where conduits, hot water and steam lines are closer than 6 inches an approved pipe covering shall be used over the conduit for the length of the run of such exposure.

W. Provide temporary closure protection for conduits during construction to prevent foreign matter from entering raceways. Provide conduit caps for empty conduits that are installed as spares to prevent foreign matter from entering raceways.

X. Raceway systems shall be installed complete, including tightening of joints, from termination point to termination point prior to the installation of conductors.

Y. Install nylon pull line in empty raceways.

Z. Underground duct banks and conduit systems:

1. Provide all material and labor of the kind required to complete the underground systems as required and as shown on the drawings. Perform all trenching and backfilling, boring, etc. necessary for the installation of underground conduits.

2. All conduit used shall be rigid galvanized metal or rigid nonmetallic, as described herein and indicated on the contract drawings. Unless noted or specified otherwise, rigid nonmetallic conduit shall be acceptable for use on underground ducts and conduit runs.

3. Clean debris from ducts by pulling a stiff bristled brush and clean rags through each conduit and temporarily plug all ends to keep them clean (spare conduits shall remain plugged).

4. Provide a pull wire (fish line) in each empty conduit consisting of a nylon rope with a breaking strength of at least 200 lbs.

5. Utilize large radius rigid galvanized steel ells at all locations where conduit enters/exits ground (whether inside or outside buildings).

6. Bends in 4 inch conduit systems shall be minimum 36 inches radius. Bends in 5 inch or 6 inch conduit systems shall be minimum 48 inch radius. The contractor may use preformed bends or bend conduits at the job site as required. All 90 degree bends must be rigid galvanized steel.

7. Utilize UL Listed couplings when transitioning between conduits constructed of different materials.

8. Underground conduit systems shall be installed so that the top of the conduit is a minimum of 36 inches below finished grade or as indicated on the contract drawings. Conduit installations not complying with these minimum cover requirements shall be concrete encased, regardless of specifications. The entire underground installation shall be free of cracks or breaks and shall be made watertight.

9. Underground conduits (rigid metal and rigid nonmetallic) specified, noted or otherwise required as being concrete-encased shall be encased in concrete envelope not less than 3 inches all around the outside limits of the conduit group. Minimum separation of individual ducts shall be 1-1/2 inches outside to outside of ducts for 4 or 5 inch conduits and 2 inches for 6 inch conduits.

10. All conduits or ducts shall be solidly supported above the trench bed and separated from each and every other duct by approved separators which will permit the placing of the concrete envelope without displacing or shifting of the individual ducts. Ducts shall be graded so that there will be no low spots or pockets for water to collect and so graded that drainage is toward manholes.

11. Concrete envelopes shall utilize 3,000 lbs. concrete as specified under General Construction Specifications. Provide steel reinforcement (i.e. rebar) for concrete encasement as indicated on the contract drawings or as required by the application.

12. All underground conduits and/or concrete envelopes (i.e. ductbanks) shall be protected from accidental excavation by means of printed plastic tapes located so as to serves as a warning device. The tape shall be not less than 6” wide by 0.004” thick and the material shall be resistant to chemicals normally found in the soil. Tape shall be installed directly above the conduit/envelope and approximately 12” below the surface.

13. Plastic tape shall be specifically designed for electric cable protection and warning. Tape shall be designed for extreme long life, colored yellow for

electric service, and shall contain continuous black imprinting "CAUTION BURIED ELECTRIC LINE BELOW". Imprinting shall be repeated every 24". Plastic tape shall be as manufactured by Terra Tape, Reef Industries Division, Griffolyn Co., Grady Co., or approved equal, furnished in continuous rolls.

14. All underground conduits or ducts terminating in manholes, transformer vaults, cable rooms, and the like, shall be provided with smooth-edged insulating fittings of the same size and of material similar to that of the duct itself. Where underground raceways enter the building, they shall be sealed to prohibit the entry of moisture, ground water, rodents, etc. Ends of conduits shall be sealed with Ductseal after cables have been installed.

15. Duct runs carried beneath roadways, driveways, etc. and for 6 feet beyond the road surface shall use rigid metal conduit of the same size as the rigid nonmetallic conduit in that portion of the run. Suitable couplings (i.e. steel to PVC, etc.), or other nonmetallic material shall be provided at the junction points and properly installed to provide watertight joints.

16. Secure the necessary permits for occupancy, cutting, crossing, etc. of any roadway when duct lines are required to be laid in or across such roadway or street, whether hard surfaced or dirt.

17. Separation from Other Utilities:

    a) Separation between conduit systems or duct banks and other underground utilities or structures paralleling it shall be sufficient to permit maintenance of the systems without damage to the paralleling structure. Separation where a conduit or duct bank crosses another underground utility or structure shall be sufficient to limit the likelihood of damage to either utility.

    b) Separation between Power and Communication Conduit Systems: The minimum clearance between power and communication conduit systems running parallel shall be 24 inches. The minimum clearance between power and communication conduit systems running perpendicular shall be 3 inches.

    c) Sewers (Sanitary and Storm): Where conduit(s) must be installed parallel and adjacent to or over a sewer line, coordinate method of installation with Contractor or Authority responsible for installing and/or maintaining the sewer. Where conduit(s) must cross over a sewer line, provide suitable supports on each side to limit or prevent the transference of any direct loads onto the line.

    d) Water Lines: Install conduit as far as practical from water lines to limit or prevent undermining in the event of a water main break. Where conduit(s) must cross over a water line, provide suitable supports on each side to limit or prevent the transference of any direct loads onto the line.

    e) Gas or Other Fuel Lines: Provide sufficient separation from gas and other fuel lines to allow use of pipe maintenance equipment. Conduit shall not enter the same manhole, handhole, vault, etc. as gas or other fuel lines.

    f) Steam Lines: Install conduit with sufficient separation to limit the likelihood of heat transference between steam line and conduit system.

16. Conduit stub ups installed in poured floors shall be effectively closed immediately after installation. Stubs shall remain closed during construction or until raceway is extended to a termination point.

17. Install raceways to prevent moisture or water from entering or accumulating within raceway systems or equipment enclosures.

3.2 FIELD ADJUSTMENTS

A. Perform field adjustments to the raceway systems as required. The adjustments shall include, but not be limited to: inspecting the interiors of raceways; clearing blockages and removing burrs, dirt, and construction debris.

END OF SECTION

SECTION 260534 – BOXES FOR ELECTRICAL SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. This section includes boxes, cabinets and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Equipment specified in this section includes but is not limited to the following:

a) Outlet and device boxes

b) Pull and junction boxes

c) Fire-rated poke-through assemblies

d) Boxes and fittings for hazardous locations

a) Cabinets

b) Composite Service Boxes (handholes)

1.2 QUALITY ASSURANCE

A. The boxes, cabinets, fittings, etc. included in this specification section shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA) 250
3. Underwriters Laboratory (UL) listed and labeled.

1.3 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of section 260500 and General Conditions of Contract for the following equipment:

1. Fire-rated poke-through assemblies
2. Boxes and fittings for hazardous locations
3. Boxes and cabinets that are to be shop fabricated (nonstock items)
4. Composite Service Boxes (handholes)

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Outlet, device, pull and junction boxes:

a) Thomas & Betts

b) E-Box

c) Hubbell

d) Oz-Gedney

2. Fire-rated poke-through assemblies:

a) Hubbell

b) Wiremold

3. Boxes and fittings for hazardous locations:

a) Oz-Gedney

b) Crouse-Hinds

c) Appleton

4. Cabinets:

a) Hoffman

b) E-Box

c) Picoma Industries

5. Composite Service Boxes (handholes):

a) Quazite

b) Synertech

c) Pencell Plastics Inc.

2.2 BOXES, CABINETS AND FITTINGS

A. General: Furnish and install proper types, sizes and NEMA classes as shown on the drawings or required per the application and field conditions. Provide complete with covers and accessories required for the intended use. Provide gasketed covers for boxes, cabinets and fittings located in damp or wet environments, or otherwise noted.

B. Materials and Finishes:

1. Sheet Steel: Flat-rolled, code-gage, galvanized steel.

2. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

3. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

4. Cast Metal for Boxes, Enclosures and Covers: Galvanized, cast iron alloy or copper-free aluminum with corrosion resistant finish.

5. Finish: The interior and exterior of items exposed in finished locations shall be baked enamel. Verify color selections with Architect.

6. Fittings for Boxes, Cabinets and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

C. Metal Outlet, Device and Small Wiring Boxes:

1. General: Conform to UL 514A & UL514B.

2. Steel Boxes: Conform to NEMA OS 1. Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.

   a) Outlet and device boxes shall be standard (2-1/4” deep) electrical boxes; shallow (1-1/2” deep) outlet boxes shall not be utilized, except where specifically noted or directed.

3. Cast Metal Boxes: Cast metal, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs. Provide with gasketed cover.

4. Fire-rated poke-through assemblies: Provide flush style fire-rated poke-through (FRPT) assemblies that are UL classified with a fire rating corresponding to that of the floor construction in which they are to be installed. The construction shall consist of an all-brass service fitting with commensurate floor finish flange and brass duplex flip-open flap type cover with locking screws. They shall be adjustable to accommodate floor thickness. Provide data, voice, video and power receptacles of type and quantity to suite application and system requirements of the specifications and drawings.

D. Pull and Junction Boxes:

1. General: Comply with UL 50 for boxes over 100 cubic inches volume. Boxes shall have screw or bolt on covers of the same material as the box.

2. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.

3. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.

4. Cast Metal Boxes: Cast metal, waterproof, with threaded raceway entries and features and accessories suitable for each location. Provide with gasketed cover.

E. Boxes and fittings for hazardous (classified) locations:

1. Cast metal or cast nonmetallic boxes conforming to UL 886, listed and labeled for use in the specified location classification and with the specific hazardous material. Conduit entrances shall be integral threaded type.

F. Cabinets

1. General: Comply with UL 50.

2. Construction: Sheet steel of size and NEMA class as shown on the drawings or required per the application and field conditions. Cabinet shall consist of a box and a front consisting of a one-piece frame and a hinged door with flush or concealed door hinges. Provide double door for cabinets wider than 24 inches. Signal system cabinets wider than 48 inches may have sliding or removable doors.

3. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power and lighting system cabinets located within mechanical and electrical rooms. Doors with locks shall be capable of closing without locking.

2.3 COMPOSITE SERVICE BOXES (HANDHOLES)

A. Provide service boxes constructed of polymer concrete reinforced with heavy-weave fiberglass. Minimum compressive strength of material shall be 11,000 psi. Provide heavy-duty covers (minimum 15,000 lb. Over 10 inch square area) with the service identification cast into cover, i.e. ELECTRIC. Provide base section and stackable extensions as required for the installation. Include stainless steel bolts to secure cover.

3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install in accordance with requirements of Section 260500 and manufacturer's recommendations.
2. Supports for boxes shall be installed in accordance with requirements of specification section 260529 and the National Electrical Code.
3. Locations: Install items where indicated and where required to suit code requirements and installation conditions.
4. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
5. Sizes shall be adequate to comply with NEC volume requirements, but in no case smaller than sizes indicated.
6. Remove sharp edges where they may come in contact with wiring or personnel.
7. Secure boxes firmly in place and set true, square with building lines.

B. Applications:

1. Cabinets: Flush mounted, NEMA enclosure type 1 except as otherwise indicated.
2. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:
   a) Interior Dry Locations: Sheet steel, NEMA type 1.
   b) Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R.
   c) Wet Locations: NEMA type 4 enclosures.
   d) Hazardous (Classified) Locations: NEMA type listed and labeled for the location and class of hazard indicated.

3. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

4. At locations where special boxes are required for systems, fire alarm, etc. the boxes shall be of the type and size as recommended by the respective system manufacturer.

C. Installation of Outlet Boxes:

1. Outlets at Windows and Doors: Locate close to window trim. For outlets indicated above doors, use mounting height as noted and center outlets above the door opening except as otherwise indicated.

2. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions.

3. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets, or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes flush with the face of the tile or other finish, without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.

4. Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:

a) Exterior locations.

b) Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).

c) Where exposed to moisture laden atmosphere.

d) At food preparation equipment within four feet of steam connections.

e) Where indicated.

5. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

6. Mounting: Mount outlet boxes for switches and receptacles with the long axis vertical or as indicated. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.

7. Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4-inches square by 1-1/2-inches deep, minimum.

8. Where installation of ceiling fans (paddle fans) is indicated on the Architectural, HVAC and/or Electrical drawings, outlet boxes shall be Listed for the application and for the weight of the fan to be supported. Installation shall comply with NEC 422.18.

9. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.

10. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

11. Concrete Boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6-inch depth.

D. Installation of Pull and Junction Boxes:

1. Size: Pull and junction boxes for feeder and branch circuits shall be of adequate size to comply with NEC volume requirements, but in no case smaller than sizes indicated.

2. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30-inches inside boxes.

3. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.

4. Signal Systems: Provide pull and junction boxes for telephone, data and other signal systems at least 50 percent larger than would be required by NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

E. Installation of Composite Service Boxes (Handholes):

1. Set service boxes on compacted subbase material.

2. Backfill around service boxes with subbase material.

3. Install top of service boxes flush with adjacent grade.

F. Grounding:

1. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

2. Provide a ground ring, rod and terminal for transformer foundations.

3. Provide ground rod and connection in each manhole and service box.

3.2 FIELD ADJUSTMENTS

A. The contractor shall inspect components and perform field adjustments as required. The adjustments shall include, but not be limited to: removing burrs, dirt and construction debris; and repairing damaged finish including chips, scratches, abrasions, and weld marks as follows:

1. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the manufacturer.

2. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating. Paint exterior manhole covers, junction box covers and frames and the access cover and frame on the transformer foundations.

END OF SECTION

SECTION 260800 - COMMISSIONING OF ELECTRICAL SYSTEMS

1 GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 26.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned shall be as specified herein.

C. The commissioning process, which the Contractor is responsible to execute, is defined herein. A Commissioning Agent (CxA) appointed by the Owner shall manage the commissioning process.

1.2 SUMMARY

A. This Section includes requirements for commissioning the Electrical systems, subsystems and equipment.

B. The commissioning activities have been developed to support the 2015 IECC and to support delivery of project performance in accordance with the Contract Documents developed with the approval of the Commonwealth.

C. Commissioning shall be performed in accordance with the 2015 IECC. All contractors must be knowledgeable of, and familiar, with these requirements and shall take same into full consideration in preparation of their submitted bid(s) and in working with the Commissioning Agent or Authority for this project.

1. No additional compensation shall be due the contractor for failure to account in submitted bid(s) for the furnishing of all labor, tools, materials or equipment necessary and required for the completion of commissioning activities in accordance with these specifications and code requirements

1.3 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in this Division is part of the construction process. Documentation and testing of these systems, as well as training of the Owner’s Operation and Maintenance personnel, is required in cooperation with the Owner and the Commissioning Agent.

B. The following Electrical systems will be commissioned:

1. Lighting Controls (Control system hardware and software, occupant sensor controls, occupancy sensor interface, daylight controls, and time-switch controls).
2. Lighting Control System (Control system hardware and software, occupancy sensor interface, daylight sensor, and unoccupied cycle control).
   a. Daylight sensor calibration and footcandle readings shall be performed when there is no contribution to outside light (i.e. during the evening when it is dark outside).
   b. Factory Certified Technician/Contractor to generate a room-by-room list of the aforementioned footcandle readings, time delay settings for occupancy sensors and footcandle setting used to dim the lights within that room.
      1. This list shall include the following:

a. The make and model of the calibrated light meter;
b. Time of day the readings were taken.
c. Room names and numbers.
d. Average footcandle reading within the room (based on the average/number of readings within the room.
e. Number of readings taken in the room

c. Take an average footcandle readings for a “room average”. Then take a footcandle reading in the center of the room and denote that under a separate line item.

1.4 SUBMITTALS

A. The commissioning process allows for review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the Construction Manager prior to forwarding to the Contractor.

B. The commissioning process allows for Submittal review simultaneously with engineering review.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists.

B. Completed checklists shall be submitted to the Owner and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission.

3.2 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 26 shall be scheduled and documented. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.3 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Owner and Construction Manager. The Contractor shall review and comment on the tests prior to approval.

B. Contractor shall provide required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed.

3.4 TRAINING OF OWNER'S PERSONNEL

A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Construction Manager and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.

B. Instruction shall be scheduled in coordination with the Construction Manager after submission and approval of formal training plans.

C. Refer to Division 26 technical Sections for additional Contractor training requirements.

END OF SECTION

SECTION 260920 – ELECTROMECHANICAL CONTACTORS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Contactors designed to provide a safe, convenient means for local or remote switching of electrical loads; complete, including all necessary relays, fuses, and associated accessories. Types of contactors in this section include the following:

a) Electromechanical Contactors:

1) Non-reversing Contactors

1.2 QUALITY ASSURANCE

A. Contactors, including all necessary relays, fuses, and associated accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. American National Standards Institute (ANSI)
4. Underwriters Laboratory (UL) listed and labeled.

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.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 16050 and General Conditions of Contract:

1. Product data sheets
2. Dimensioned outline drawing
3. Conduit entry/exit locations
4. Cable terminal sizes
5. Ratings including:

a) Voltage

b) Horsepower and/or continuous current

6. Fuse ratings and type

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Final as-built drawings

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Square D (Basis of design)
2. Eaton/Cutler-Hammer
3. Siemens
4. General Electric

2.2 ELECTROMECHANICAL CONTACTORS

A. Non-reversing Contactors

1. Contactors shall have UL certification to achieve IEC 947, type 2 coordination when subjected to 100,000 ampere short-circuit fault currents.
2. Magnetic contactors through NEMA Size 9 shall be equipped with double break silver alloy contacts.
3. Coils shall be of molded construction through NEMA Size 9.
4. Coils shall be color-coded through size 5 and permanently marked with voltage, frequency and part number.
5. NEMA Size 00 through 2 contactors shall be suitable for adding a minimum of any combination of six (6) normally open or normally closed contacts. Size 3 through 8 contactors shall be suitable for the addition of up to eight (8) external auxiliary contacts of any combination of normally open or normally closed contacts.
6. Enclosures shall be NEMA 3R as indicated on the drawings.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 260500 and manufacturer’s recommendations.

3.2 TESTS

A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

END OF SECTION

SECTION 262416 - PANELBOARDS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrical panelboards; complete, including all necessary circuit breakers, termination equipment and associated accessories. Equipment specified in this section includes but is not limited to the following:

a) Panelboards

b) Panel Aprons

1.2 QUALITY ASSURANCE

A. The panelboards and associated accessories shall be designed, manufactured, installed and tested in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70 - National Electrical Code (NEC)
2. ANSI/National Electrical Manufacturers Association (NEMA) PB 1 – Panelboards
3. NEMA AB 1 – Molded Case Circuit Breakers and Molded Case Switches
4. NEMA PB 1.1 – General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
5. Underwriters Laboratory (UL) 489 – Molded Case Circuit Breakers and Circuit Breaker Enclosures
6. UL 50 – Enclosures for Electrical Equipment
7. UL 67 – Panelboards
8. UL 943 – Ground Fault Circuit Interrupters

B. The manufacturer of the assembly shall be the manufacturer of the circuit protective devices within the assembly.

C. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

D. 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.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Breaker layout drawing with dimensions indicated and nameplate designation
2. Component list
3. Conduit entry/exit locations
4. Assembly ratings including:
   a) Short-circuit rating
   b) Voltage
   c) Continuous current
5. Cable terminal sizes
6. Product data sheets
7. Certified trip curves for each specified product

B. Submit to Engineer the Short Circuit / Coordination Study and Arc Flash Hazard Analysis with this submittal in accordance with the requirements of section 260500 and this section.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Recommended renewal parts list
3. Short Circuit / Coordination Study and Arc Flash Hazard Analysis

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Eaton/Cutler-Hammer
2. Square D (Basis of Design)
3. GE
4. Siemens

B. All components shall be the product and assembly of the same manufacturer, or equivalent products of a number of manufacturers, which are suitable for use in a unified system.

2.2 PANELBOARDS

A. Panels shall be as shown on the drawings and shall be dead front, safety type made up of molded insulating sections, arranged so that each section can be easily removed without disturbing the others.

B. Panels shall be designed so that the branch circuit connections to the main bus provide sequenced (i.e. fully distributed) phasing. Panels shall be equipped with plated copper bussing.

C. Panels shall have mains (types, sizes, voltages, phases) and circuit breakers (types, trip ratings, quantities, etc) all as scheduled on electrical drawings. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Article 230.

D. Circuit breakers shall be bolt-on type, quick-make and quick-break with thermal-magnetic trips. Equipment shall be provided with available interrupting current ratings as noted on the drawings.

1. Circuit breakers for use in 208-volt or 240-volt panels shall have a minimum interrupting rating of 10,000 amperes RMS symmetrical or as indicated on the drawings.

E. All branch breakers 15 to 100 amperes shall be able to be mounted in any panel position for twin or double mounting, without space penalty. Two- and three-pole circuit breakers shall have internal common trip crossbars, for simultaneous tripping of each pole.

F. Interiors shall be field convertible for top or bottom incoming feed. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications. Interiors shall accept 125 amperes circuit breakers for group mounted branch construction. All lugs shall be rated for 75º C terminations and shall be suitable for use with either copper or aluminum conductors.

G. Provide a solidly bonded copper equipment ground bar with individual connections for each branch circuit ground conductor. Ground bars/buses shall be rated at full capacity of the main bus rated current.

H. Split solid neutral shall be plated and located in the mains compartment up to 250 amperes so all incoming neutral cables may be of the same length.

I. Each section of a multi-section panel shall have full capacity main and be fed with the full capacity of the feeder. Provide suitable double lugs, auxiliary pull box, and/or connecting insulated bus bars as required.

J. Cabinets shall be at least 20 inches wide and made from code gauge galvanized steel. The panelboard front shall consist of a flat piece of sheet steel with an opening to which the panelboard door is attached by means of semi-concealed hinges. Door shall be provided with flush type, combination cylinder latch and lock. Provide minimum gutter in accordance with NEC. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

K. Cabinets for multi-section panels shall have both/all sections bolted together, arranged side by side with back boxes and trim at the same height. Each section shall be provided with a separate door.

L. Provide an engraved nameplate for each panel section. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum.

M. All panelboards shall be equipped with common keyed locks. Provide minimum of two (2) keys per panel.

N. A typewritten schedule of circuits, approved by the Architect, shall be provided with plastic cover and mounted in a suitable frame on the inside of each panel cabinet door. Handwritten schedules may be utilized during construction but shall not be acceptable for the final installation.

O. Circuit numbers indicated on the drawings are for the purpose of clarifying the grouping of outlets into circuits. The actual number allotted to the circuit in the panel as installed shall be adjusted to suit the bussing and branch circuiting of the panel and to balance the loads.

P. Where called for on schedule, "space" shall mean to include all necessary bus, device supports and connections for future installation of circuit breakers.

Q. From each flush mounted panelboard, extend two (2) one inch empty conduits into the ceiling space above the panel and terminate in a six inch square junction box.

R. Provide locking devices on circuit breaker handles as required on circuits providing emergency services.

S. Where indicated on the drawings, provide panelboards with integral Surge Protection Devices in accordance with Section 264313.

T. All current carrying parts shall be of 98% conductivity copper.

2.3 FINISH

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

2.4 PANEL APRONS

A. Where surface mounted panels occur, exposed conduit or duct from panel to floor and from panel to ceiling shall be covered with a heavy-gauge steel apron. Panel aprons shall not be required in unfinished rooms (electrical closets, mechanical rooms, etc.) unless otherwise noted.

B. The steel apron shall be formed to the size of the panel and be securely fastened to the bottom/top of the panel and anchored to the wall on either side. The apron shall fit snugly to the floor and ceiling. Ample bracing shall be provided to prevent the apron from being bumped or pushed out of shape or place. All bracing shall be concealed on the inside of the apron. The apron shall be made of not less than 12-gauge steel. Inside braces shall be not less than 1-1/4" x 1/4" steel. Where conduits enter the floor slab from surface mounted panels, a concrete block 4 inches high by the width and depth of the

panel shall be poured around the conduits. The steel apron may be attached to this concrete pad.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of section 260500 and manufacturer's recommendations.

B. Make all necessary field measurements to verify that equipment shall fit in the allocated space in full compliance with minimum required clearances indicated on the drawings or specified in the National Electrical Code.

C. Verify that required utilities are available, in proper location and ready for use.

3.2 TESTS

A. The standard factory tests, in accordance with the latest applicable ANSI and NEMA standards, shall be performed on the equipment provided under this section.

1. Upon request, the manufacturer shall provide three (3) certified copies of standard factory test reports.

3.3 FIELD ADJUSTMENTS

A. Perform field adjustments as required to place the equipment in final operating condition.

B. Inspect installed panelboards for physical damage, proper alignment, anchorage, and grounding.

C. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads in accordance with section 16050. Maintain proper phasing for multi-wire branch circuits.

D. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

E. Necessary field adjustments and minor modifications to equipment shall be carried out by the Contractor at no additional cost to the owner.

F. Cleaning:

1. Clean enclosures and interiors of panels to remove construction debris, dirt, shipping materials, etc.

2. Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION

SECTION 262726 - WIRING DEVICES

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wiring devices for electrical systems; complete, ready for operation, including all necessary parts, accessories, connections and equipment. Refer to individual system sections for special wiring device specifications. Types of wiring devices in this section include the following:

a) Switches

b) Key Switches

c) Convenience Receptacles

d) Ground Fault Circuit Interrupting (GFCI) Receptacles

e) Power Outlet Receptacles

f) Wall Plates

g) Wireless Receptacle Control

1.2 QUALITY ASSURANCE

A. The wiring devices and associated accessories included in this specification section shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. American National Standards Institute (ANSI)
4. Underwriters Laboratory (UL) listed and labeled.

1.3 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of section 260500 and General Conditions of Contract for equipment included in this specification.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the operation and maintenance information in accordance with requirements of section 260500 and General Conditions of Contract for equipment included in this specification.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Switches, Convenience Receptacles, GFCI Receptacles, Dual-Controlled Plug Load Receptacles, TVSS Receptacles, Power Outlet Receptacles and Wall Plates:
   a) Pass & Seymour/Legrand
   b) Hubbell
   c) Leviton
   d) Cooper
2. Telephone, Data and Television Outlets: See corresponding system specification sections.
3. Wireless Receptacle Control:
   a) Pass & Seymour/Legrand or equal
   b) Wattstopper
   c) Pre-approved equal

2.2 COMMERCIAL GRADE SWITCHES

A. Provide commercial grade toggle switches of single pole, double pole, 3-way, 4-way, illuminated and pilot lighted types as indicated per the contract documents and as required by the application. Switches shall be rated not less than 20 amperes at 120/277 volts AC. Switches shall feature silver-alloy contacts with quiet-action mechanism, and combination terminal and mounting screws (Philips-head, slotted). Switches shall be designed for back and side wiring and shall accept #14, #12 and #10 AWG solid or stranded wire. Molded parts of switches shall be constructed from impact-resistant thermoplastic nylon. Verify color selections with Architect.

1. Commercial grade switches shall feature:
   a) Heavy-gauge plated steel mounting strap with ground contact.
   b) One-piece brass alloy contact arm.

2.3 COMMERCIAL GRADE CONVENIENCE RECEPTACLES

A. Provide commercial grade convenience receptacles in single- and duplex-outlet configurations of the styles and types indicated per the contract documents and as required by the application. Receptacles shall be rated at not less than 20 amperes at 125 volts AC (NEMA 5-20R). Receptacles shall feature triple-wipe power contacts constructed of brass. Receptacles shall be designed for back and side wiring with provisions for split circuit wiring via break off tabs. Receptacles shall accept #14, #12 and #10 AWG solid or stranded wire. Back wiring clamps shall be v-shaped and serrated for three-point contact with wires. Receptacles shall feature a plated steel mounting strap with ground contact and self-grounding clip. Molded parts of receptacles shall be constructed from impact-resistant thermoplastic nylon. Verify color selections with Architect. Receptacles fed from a normal/emergency source shall be red. Provide the following convenience receptacles:

B. Ground Fault Circuit Interrupting (GFCI) receptacles shall:

1. Generally comply with the above specified requirements for commercial grade convenience receptacles.

2. GFCI devices shall have an auto-monitoring function that will allow for Self-Testing.
3. Comply with UL 943 requirements.
4. Comply with UL Class A requirements.
5. Feature trip threshold that shall meet or exceed UL requirements for trip time.
6. Feature trip test and reset buttons.
7. Feature a trip indicator light.
8. Feature lockout protection. If critical components are damaged and ground fault protection is lost, power to receptacle is disconnected.

2.4 POWER OUTLET RECEPTACLES

A. Provide power outlet receptacles of the flush mounted, single-outlet, three or four wire variety as required by the service indicated on the drawings. The power outlet receptacles shall have a capacity of 20, 30, 50 or 60 amperes at rated voltage indicated and of sufficient capacity to accommodate the load to be connected. The receptacles shall feature heavy-gauge, double-wipe copper alloy power contacts. The receptacles shall accept up to #4 AWG conductors. Molded parts of receptacle shall be constructed from arc-resistant thermoplastic. Each receptacle shall be provided with a stainless steel plate and the associated plug to fit receptacle. Grounding type plugs shall be provided where required by the NEC or applicable codes. Verify color selections with Architect.

2.5 WALL PLATES

A. General: Furnish and install wall plates with beveled edges for all local control switches, convenience receptacles, miscellaneous wiring devices and blank outlets. Where more than one device occurs at one point, gang plates shall be used. Plates and mounting screws shall match the color of the devices to which they are to be attached. Verify color selections with Architect.

B. Materials and Finishes:

1. Thermoplastic: High impact thermoplastic, nylon material.
2. Weatherproof While-In-Use Covers:
   a) Body, cover and plates shall be made of polycarbonate. Shall be non-conductive and non-corrosive.
   b) Gasket shall be pre-applied. Constructed of closed-cell foam, neoprene blend regular density and UL rated HBF.
   c) Shall provide a water channel, which keeps water moving outside while cord flap keeps the inside dry.
   d) Shall be able to mount vertically or horizontally.
   e) Must conform to NEMA 3R.

2.6 OCCUPANCY SENSORS

A. Refer to the occupancy sensor schedule on the drawings for basis of design sensor type(s).

2.7 WIRELESS RECEPTACLE CONTROL

A. Provide plug load RF signal packs of the styles and types indicated per the contract documents and as required by the application. Signal packs shall be rated at not less than 125 volts AC. Signal packs shall accept #14, #12 and #10 AWG copper conductor only.

1. Wireless Plug Load RF Signal Pack

a) Terminal identification shall be in accordance with UL498.

b) Transmitter shall be compliant with Part 15 of the FCC rules.

c) Shall be able to control up to 16 RF Receptacles with one signal pack.

d) 30’ communication range min.

B. Dual-Controlled Plug Load receptacles shall:

1. Generally comply with the above specified requirements for commercial grade convenience receptacles.

2. Be UL Listed to standard 498B, Latest Edition.

3. Feature a manual override on receptacle face.

4. Feature feed-thru capability; allowing for downstream control of multiple receptacles.

5. Feature a multi-color visual LED indicator light to indicate status of the receptacle.

6. NEMA approved controlled receptacle marking pad printed on the face of the receptacle (by manufacturer).

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 260500 and manufacturer’s recommendations.

B. ALL Receptacles and power outlets shall be labeled in accordance w/ owner requirements including but not limited to panelboard name and circuit number (example….LP-24). Coordinate exact labeling requirements with owner prior to installation.

C. Install wiring devices and accessories as indicated, in accordance with manufacturer’s written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

D. Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other work.

E. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the E.C. shall check with other contractors concerned, to determine exact field location of the above items. In addition, the E.C. shall check for exact direction of door swings so that local switches are properly located on the strike side.

F. Install wiring devices only in electrical boxes that are clean and free from building materials, dirt and debris.

G. Install wiring devices after wiring work is completed.

H. Install wall plates after painting work is completed. Use galvanized steel wall plates in unfinished spaces unless otherwise noted.

I. Where more than one wiring device occurs in any one location, arrange devices in gangs with common cover plate. Where ganged switches serving 277V lighting are served by different circuits, so as to result in the voltage between switches exceeding 300V, provide barriers in box per NEC Section 404.8(B).

J. In locations where several pieces of wall-mounted equipment such as wall switches and thermostats are in the same general area, all shall be installed and grouped in a neat, orderly fashion, all of the same horizontal or vertical center line, whichever the case may be. Variation from this direction shall be approved by the Architect. All receptacles, switches and other wall mounted wiring devices shall generally be installed at the mounting heights indicated on the drawings or as specified in Section 260500.

3.2 FIELD ADJUSTMENTS

A. Subsequent to the final connection of the wiring devices, energize circuits and demonstrate proper functioning.

B. Perform any corrections and adjustments required at no additional cost to the owner. This shall include setting of time delays and adjusting sensitivity/coverage areas for occupancy sensors.

END OF SECTION

SECTION 262800 – LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrical overcurrent devices; complete, including all necessary termination equipment and associated accessories. Equipment specified in this section includes but is not limited to the following:

   a) Fuses

   b) Enclosed Circuit Breakers

1. Circuit breaker and fuse types shall be selected by the manufacturer so that all components are selectively coordinated. All breakers shall be provide so that they are in compliance with the short circuit and protective device coordination studies and provide a fully coordinated power system.

1.2 QUALITY ASSURANCE

A. The fuses, circuit breakers and associated accessories shall be designed, manufactured, installed and tested in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA):
3. Underwriters Laboratory (UL):

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.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 16050 and General Conditions of Contract:

1. Product data sheets
2. Ratings including:

   a) Short-circuit rating

   b) Voltage

   c) Continuous current

3. Cable terminal sizes

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Recommended renewal parts list

2 PRODUCTS

2.1 FUSES

A. For every fuse clip to which a circuit has been connected under this contract, furnish and install a dual-element time delay cartridge fuse capable of carrying 500 percent of its rated ampere load for a minimum of ten (10) seconds. Fuses shall have a minimum interrupting capacity of 100,000 RMS amperes and shall be labeled as Class RK-1.

B. Basis of design for fuses is Bussman RK-1 Low-Peak.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Operating Mechanism:

1. The circuit breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover.
2. Provisions for padlocking the circuit breaker in the OFF position shall be provided.

B. Enclosure

1. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphatized steel (Type 1).
2. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphatized galvannealed steel (Type 3R).
3. Shall be flush mounted where indicated or shown on drawings.

C. Short Circuit Rating:

1. The integrated equipment short circuit current rating shall be equal to the interrupting rating at the supply voltage marked on the circuit breaker installed, up to 200,000 rms symmetrical amperes short circuit current.

D. Switch Enclosures:

1. Indoors: NEMA 1 enclosure unless indicated otherwise
2. Outdoors: NEMA 3R enclosure

E. Acceptable Manufacturers:

1. Eaton/Cutler-Hammer
2. Square D

3. GE

4. Siemens

F. All components shall be the product and assembly of the same manufacturer, or equivalent products of a number of manufacturers, which are suitable for use in a unified system.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 260500 and manufacturer's recommendations.

END OF SECTION

SECTION 262816 - DISCONNECT SWITCHES

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Safety Switches for electrical circuits and motors; complete, ready for operation, including all necessary parts, accessories, connections and equipment.

B. Refer to Section 260500: Disconnect Switches for equipment provided under the Mechanical sections of the Specifications (Divisions 21 thru 25) shall be furnished under that Division and shall comply with the requirements of this section. Disconnect Switches for all other equipment shall be provided by the Electrical contractor unless otherwise noted.

1.2 QUALITY ASSURANCE

A. Disconnect switches and associated accessories included in this specification section shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA), KS-1
3. Underwriters Laboratory (UL) listed and labeled, UL 98.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Product data sheets
2. Dimensioned outline drawing
3. Conduit entry/exit locations
4. Cable terminal sizes
5. Switch ratings including:
   a) Short-circuit rating
   b) Voltage
   c) Continuous current
   d) Horsepower rating
6. Fuse ratings and type (as applicable)

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Provide outline drawings with dimensions, and equipment ratings for voltage, amperage, horsepower and short circuit.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Safety Switches

a) Eaton/Cutler-Hammer

b) Square D

c) GE

B. Disconnect switches provided as “integral” to mechanical equipment furnished under the Mechanical sections of these specifications (Divisions 21 thru 25) shall be factory installed and warranted by the respective equipment manufacturer.

2.2 SAFETY SWITCHES (HEAVY-DUTY)

A. Switch Interior:

1. All switches shall have switch blades which are visible when the switch is OFF and the cover is open.

2. Lugs shall be front removable and UL Listed for 60° C or 75° C conductors (30-100 ampere), 75° C conductors (200-1200 ampere), and aluminum or copper conductors.

3. All current carrying parts shall be plated to resist corrosion.

4. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.

5. Switches shall have provisions for a field installable electrical interlock.

B. Switch Mechanism:

1. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.

2. The operating handle shall be an integral part of the box and not the cover.

3. Provisions for padlocking the switch in the OFF position shall be provided.

4. The handle position shall travel at least 90□ between OFF and ON positions to clearly distinguish and indicate handle position.

5. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently

disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not enter the enclosure in order to override the interlock.

C. Switch Type:

1. Unless otherwise indicated, safety switches shall be non-fusible type.

D. Switch Enclosures:

1. Indoors: NEMA 1 enclosure unless indicated otherwise
2. Outdoors: NEMA 3R enclosure

E. Switch Ratings:

1. Switches shall be horsepower rated as shown on the drawings or as required for the application.

2.3 NAMEPLATES

A. Nameplate shall be front cover mounted, containing a permanent record of switch type, ampere rating, and maximum voltage rating.

3 EXECUTION

3.1 INSTALLATION

A. Install in conjunction with requirements of section 260500 and manufacturer's recommendations.

B. ALL Disconnects shall be labeled in accordance w/ owner requirements including but not limited to panelboard name and circuit number (example….LP-24). Coordinate exact labeling requirements with owner prior to installation.

C. Install Disconnects and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

D. Unless otherwise noted, disconnects shown on the electrical drawings for equipment specified in the Mechanical sections of these specifications (Divisions 21 thru 25) will be furnished by the respective contractor and delivered to the Electrical Contractor for installation.

E. Disconnects installed for Mechanical equipment (i.e. motors, condensing units, fans, etc.) shall be mounted in the immediate vicinity of the equipment as shown on the drawings. Where disconnects are shown to be mounted to the equipment which they serve, mounting shall be performed in accordance with the equipment manufacturers recommendations so as to not void any product warranties.

F. Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of disconnects with other work.

G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Electrical contractor shall check with other contractors concerned, to determine exact field location of the above items.

3.2 FIELD ADJUSTMENTS

A. Perform any corrections and adjustments required at no additional cost to the owner.

B. Subsequent to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Except as otherwise indicated, do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation, and for verification of type and rating of fuses installed. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

END OF SECTION

SECTION 263213 – ENGINE-DRIVEN GENERATOR SETS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Diesel emergency/standby generator (200kW and larger); complete, ready for operation, including all necessary parts, accessories, connections, tests and equipment.

1.2 QUALITY ASSURANCE

A. The emergency/standby generator(s) and all components shall be designed, manufactured, installed and tested in accordance with the latest editions of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Fire Protection Association (NFPA) 110, Emergency and Standby Power Systems
3. National Electrical Manufacturers Association (NEMA)
4. Institute of Electrical and Electronics Engineers (IEEE)
5. Underwriters Laboratory (UL) listed and labeled.
6. American National Standards Institute (ANSI)
7. Environmental Protection Agency (EPA)

B. 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.

C. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of this application. This shall include both vertical and lateral required response spectra. Alternatively, the manufacturer's certification may be based on a detailed computer analysis of the entire assembly structure and its components. Guidelines for the installation consistent with these requirements shall be provided by the manufacturer and be based upon testing of representative equipment. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. The test response spectra shall meet or exceed the required response spectra peak acceleration for this application.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
2. A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.

3. Manufacturer's published warranty documents shall be provided for all products covering against defects in materials and workmanship for a one year period from the start-up date.

4. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.

5. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.

6. Manufacturer’s installation information.

B. Submit to Engineer the Short Circuit / Coordination Study and Arc Flash Hazard Analysis with this submittal in accordance with the requirements of section 260500 and this section.

C. Proposed substitutions shall be in accordance with section 260500 and General Conditions of Contract and include complete submittal data clearly denoting any and all deviations and/or exceptions to the equipment specified.

1.4 OPERATIONS AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Instruction books and/or leaflets

2. Recommended renewal parts list

3. Final as-built drawings

4. Manufacturer's certification of prototype testing

5. Seismic certification and equipment anchorage details

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Kohler (Basis of design)

2. Cummins Power Systems

3. Caterpillar

4. MTU Onsite Energy

2.2 DIESEL ENGINE-GENERATOR SET

A. 4-cycle, 1800 rpm, diesel engine generator set. The generator set standby kW and kVA ratings at 0.8 PF shall be as noted on the drawings, based on site conditions noted below. System voltage shall be as noted on the drawings. Site Conditions: Altitude 350ft., ambient temperatures up to 104 degrees F. Generator set shall be listed per UL2200 Stationary Generator Assembly for installation and use in ordinary locations in accordance with the National Electrical Code, NFPA 70; the standard for Health Care Facilities, NFPA 99; and the Standard for Emergency and Standby Power System, NFPA 110.

B. Prototype Tests and Evaluation: Prototype tests shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement. Prototype testing shall comply with the requirements of NFPA 110 for level 1 systems.

C. Performance: Voltage regulation shall be +/- 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed +/- 0.5 percent.

D. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

E. Motor starting capability shall be a minimum of 375 kVA/300 kW. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.

F. Engine: The engine shall be diesel, 4 cycle, radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

1. An electronic governor system shall provide automatic isochronous frequency regulation.
2. Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the generator air inlet. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with 50/50 ethylene glycol/water mixture by the equipment supplier. Rotating parts shall be guarded against accidental contact per OSHA requirements.
3. An electric starter(s) capable of three complete cranking cycles without overheating.
4. Positive displacement, mechanical, full pressure, lubrication oil pump.
5. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
6. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element.
7. Replaceable dry element air cleaner with restriction indicator.
8. Flexible supply and return fuel lines.
9. Engine mounted battery charging alternator, 45 ampere minimum, and solid-state voltage regulator.

G. AC Generator:

1. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees Centigrade.
2. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

3. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds

H. Engine-Generator Set Control:

1. The generator set shall be provided with a microprocessor-based control system designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. The control shall be mounted on the generator set and shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. The control shall be UL508 listed, CSA282-M1989 certified, and meet IEC8528 part 4. All switches, lamps and meters shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts. The controls shall meet or exceed the requirements of Mil-Std 461C part 9, and IEC Std 801.2, 801.3., and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions. The entire control shall be tested and meet the requirements of IEEE587 for voltage surge resistance. The generator set mounted control shall include the following features and functions:

a) Three position control switch labeled RUN/OFF/AUTO. In the RUN position the generator set shall automatically start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

b) Red "mushroom-head" push-button EMERGENCY STOP switch. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

c) Push-button RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

d) Push-button PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

e) Generator Set AC Output Metering: The generator set shall be provided with a metering set with the following features and functions:

1) Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.

2) Note that both analog and digital metering are required.

f) Generator Set Alarm and Status Message Display: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing alarm and shutdown conditions. The lamps shall

be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel:

1) low oil pressure (alarm)
2) low oil pressure (shutdown)
3) oil pressure sender failure (alarm)
4) low coolant temperature (alarm)
5) high coolant temperature (alarm)
6) high coolant temperature (shutdown)
7) engine temperature sender failure (alarm)
8) low coolant level (alarm or shutdown--selectable)
9) fail to crank (shutdown)
10) overcrank (shutdown)
11) overspeed (shutdown)
12) low DC voltage (alarm)
13) high DC voltage (alarm)
14) weak battery (alarm)
15) low fuel-daytank (alarm)
16) high AC voltage (shutdown)
17) low AC voltage (shutdown)
18) under frequency (shutdown)
19) over current (warning)
20) over current (shutdown)
21) short circuit (shutdown)
22) ground fault (alarm)
23) over load (alarm)
24) emergency stop (shutdown)
25) In addition, provisions shall be made for indication of two customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

g) Engine Status Monitoring: The following information shall be available from a digital status panel on the generator set control :

1) engine oil pressure (psi or kPA)

2) engine coolant temperature (degrees F or C)

3) engine oil temperature (degrees F or C)

4) engine speed (rpm)

5) number of hours of operation (hours)

6) number of start attempts

7) battery voltage (DC volts)

8) The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

2. Control Functions:

a) The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.

b) The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

c) The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

d) The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

e) The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

3. Alternator Control Functions:

a) The generator set shall include an automatic voltage regulation system that is matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alpha-numeric LED readout to indicate setting level.

b) Controls shall be provided to monitor the output current of the generator set and initiate an alarm when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut

down and lock out the generator set when output current level approaches the thermal damage point of the alternator.

c) Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.

d) Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

e) An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

f) A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated.

g) When required by National Electrical Code or indicated on project drawings, the control system shall include a ground fault monitoring relay. The relay shall be adjustable from 100-1200 amps, and include adjustable time delay of 0-1.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.

4. Control Interfaces for Remote Monitoring:

a) All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure. Provide the following features in the control system:

1) Form "C" dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.

2) One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.

3) A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

4) A fused 20 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

5) The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the drawings.

I. Base: The engine-generator set shall be mounted on a heavy duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

J. Generator Set Auxiliary Equipment and Accessories:

1. Coolant Heater: Engine mounted, thermostatically controlled, coolant heater for each engine. Heater voltage shall be as shown on the drawings. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system. Provide proper power supply circuits for the heater as required for the voltage and load of the heater. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements.

2. Vibration Isolation: Vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.

3. Exhaust Silencer: Exhaust muffler shall be provided for each engine, size and type as recommended by the generator set manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the generator set manufacturers recommendations and applicable codes and standards.

4. Starting and Control Batteries: Starting battery bank, calcium/lead antimony type, 24 volt DC, sized as recommended by the generator set manufacturer, shall be supplied for each generator set with battery cables and connectors.

5. Generator Set Main Circuit Breaker: Set-mounted and wired, UL listed, molded case type with adjustable electronic trip unit with ratings as indicated on the drawings. Submittals shall demonstrate that the circuit breaker provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection.

6. Remote Annunciator: Provide and install a 20-light LED remote alarm annunciator with horn, located as shown on the drawings or in a location which can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems; and in addition shall provide indications for high battery voltage, low battery voltage, loss of normal power to the charger. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall

sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2.

7. Outdoor Weather-Protective Sound Attenuating Housing: The generator set shall be provided with a factory-installed sound-attenuated housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 75 dBA at any location 7 meters from the generator set in a free field environment. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustical materials used shall be oil and water resistant. No foam materials shall be used unless they can be demonstrated to have the same durability and life as fiberglass.

   a) The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and padlockable door latches shall be provided for all doors. Door hinges shall be stainless steel.

   b) The enclosure shall be provided with an exhaust silencer that is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a rain cap and rain shield.

   c) All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electrocoating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating which meets the following requirements:

      1) Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.

      2) Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.

      3) Crosshatch adhesion, per ASTM D3359-93, 4B-5B.

      4) Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.

      5) Salt Spray, per ASTM B117-90, 1000+ hours.

      6) Humidity, per ASTM D2247-92, 1000+ hours.

      7) Water Soak, per ASTM D2247-92, 1000+ hours.

      8) Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

8. Sub-Base Fuel Storage Tank: Provide a dual wall sub-base fuel storage tank with 72 hours fuel capacity at 100% rated load. The tank shall be constructed of corrosion resistant steel and shall be UL listed. The equipment, as installed, shall meet all local and regional requirements for above ground tanks.

2.3 CONCRETE PAD

A. Provide concrete pad for generator mounted on grade outside the building (minimum total load of 10,000 pounds). Pad shall be of 8” thick with minimum 42” frost wall and 12 x 12 x #4 wire mesh embedded in the concrete. Pad shall extend a minimum of 6” beyond the equipment in all directions, with the top 2” above surrounding grade. Chamfer top edge 1”.

3 EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. Perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Fuel system and related piping to be provided and installed by the Plumbing contractor.

D. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

F. Upon project completion, contractor shall verify that generator fuel tank has been filled to capacity.

3.2 TESTS

A. Equipment shall be initially started and operated by representatives of the manufacturer.

B. Factory Tests: Equipment supplied shall be fully tested at the factory for function and performance. Generator set factory tests on the equipment shall be performed at rated load and rated PF. Generator sets that have not been factory tested at rated PF will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

C. On-Site Acceptance Test: The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

D. Installation acceptance tests to be conducted on-site shall include a minimum of ten (10) starts of the engine-generator set, minimum of ten (10) operations of transfer switches, 8-hour maintained operation under conditions of randomly applied load at 10% to 100% of rated capacity. Loading shall be by use of a resistive load bank; make temporary connections for load testing as necessary.

E. Provide certified results of testing, including frequency and voltage regulation at 25%, 50%, 75% and 100% of rated load, fuel consumption and exhaust emissions at above load ratings, actual measured values for pickup and drop out relays for automatic transfer switches, and measured values for time delay relays.

3.3 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

END OF SECTION

SECTION 263600 - TRANSFER SWITCHES

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

1.2 QUALITY ASSURANCE

A. The switches, including all necessary contactors, relays, fuses, and associated accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Fire Protection Association (NFPA) 99 - Essential Electrical Systems for Health Care Facilities
3. National Fire Protection Association (NFPA) 110, Emergency and Standby Power Systems
4. National Fire Protection Association (NFPA) 20, Installation of Stationary Pumps For Fire Protection
5. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches Institute of Electrical and Electronics Engineers (IEEE)
6. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
7. Underwriters Laboratory (UL) 1008 7th edition listed and labeled.
8. American National Standards Institute (ANSI)
9. IEC 60947 – 6 – 1
10. CSA C22.2 No 178 - 1978
11. International Standards Organization ISO 9001

B. 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.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Product data sheets
2. Dimensioned outline drawing
3. Conduit entry/exit locations
4. Cable terminal sizes
5. Ratings including:
   a) Voltage
   b) Continuous current
   c) Withstand Current Rating (WCR)
6. Fuse ratings and type

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Final as-built drawings
3. Recommended renewal parts list

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. ASCO (Automatic Switch Company) ASCO 4000 Series.
   a) 100A model number: 4ADTSA3100C5XC, 14A/B, 18Z, 31Z
   b) 400A model number: 4ADTSA3400C5XC, 14A/B, 18Z, 31Z
   c) 600A model number: 4ADTSA3600C5XC, 14A/B, 18Z, 31Z
2. Russ Electric
3. Siemens
4. Or approved equal

B. The basis of design for the equipment, documentation, and services described in this specification and shown on the plans are as provided by ASCO Power Technologies.

2.2 AUTOMATIC TRANSFER SWITCH

A. The Automatic Transfer Switch shall transfer the load in an Open Transition (break before make) operation. Transfer switch shall have one solenoid mechanism, momentarily energized to operate both Normal and Emergency contacts during transfer.

B. The Delayed Transition Transfer Switch shall transfer the load in delayed transition (break-before-make) mode. Transfer is accomplished with a user-defined interruption period in both directions adjustable from 1 second to 5 minutes in at least 15 increments.

C. Where solid neutral conductors are to be installed, a neutral terminal plate with fully rated AL-CU pressure connectors shall be provided.

D. Transfer Switch Equipment: Provide complete factory assembled transfer equipment with electronic controls designed for surge voltage isolation, and including voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts.

E. Transfer Switch Ratings: Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosures, and accessories.

F. Main contacts shall be rated up to 600 Volts AC.

G. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure, in ambient temperatures of -40 to +50 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 M).

H. Transfer switch equipment shall have a Withstand Close on Rating(WCR) in RMS symmetrical amperes shown on the drawings. The transfer switch and its upstream protection shall be coordinated.

I. Construction: Transfer switches shall be double-throw solenoid operated, electrically and mechanically interlocked, and mechanically held in both positions.

J. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600amps and higher shall have front removable and replaceable contacts. All stationary and movable contacts shall be replaceable without removing power conductors and/or bus bars.

K. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs, sized to carry 100% of the current designated on the switch rating.

L. Enclosures shall be UL listed. The enclosure shall provide NEC compliant wire bend space. The cabinet door shall be key-locking. Controls on cabinet door shall be key-operated.

1. Indoors: NEMA 1 enclosure unless indicated otherwise
2. Outdoors: NEMA 3R enclosure

M. Transfer switches shall be mounted in enclosures as designated on the drawings. Separate enclosures shall be the NEMA type specified. The cabinet shall provide required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

2.3 AUTOMATIC CONTROLS / MICROPROCESSOR:

A. Transfer switches that are designated on the drawing as automatic shall be provided with a fully automatic control system, and provisions for manual operation as described in this section.

B. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.

C. The controller shall meet or exceed the requirements of Electromagnetic Compatibility (EMC)

1. EN 55011:1991 — Emission standard - Group 1, Class A
2. EN 50082-2:1995 — Generic immunity standard, from which:
   a) EN 61000-4-2:1995 — Electrostatic discharge (ESD) immunity
   b) ENV 50140:1993 — Radiated Electro-Magnetic Field immunity
   c) EN 6100-4-4: 1995 — Electrical fast transient (EFT) immunity
   d) EN 61000-4-5 — Surge Transient immunity
   e) En61000-4-6: 1996 — Conducted Radio Frequency Field Immunity

D. Solid-state undervoltage sensors shall simultaneously monitor all phases of both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.

E. Controls shall be provided with solid-state overvoltage sensors, adjustable from 102-115% of nominal, to monitor all phases of the normal and emergency sources. Provide adjustable time delay of 0to 6sec.

Parameter	Sources	Dropout / Trip	Pickup / Reset
Undervoltage	N&E,3ϕ	70 to 98%	85 to 100%
Overvoltage	N&E,3ϕ	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

1. Provide In-Phase Monitor to protect against inadvertent phase rotation hookup and monitor for voltage phase imbalance between phases.

2. The switch shall transfer when the emergency source reaches the set point voltage and frequency. Provide a solid-state time delay on transfer, adjustable from 0 to 120 seconds.

3. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 0 to 30 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.

4. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 10 minutes, beginning on return to the normal source.

5. Power for transfer operation shall be from the source to which the load is being transferred.

6. The control shall include remote transfer inhibit.

F. Front Panel Devices: Provide devices mounted on cabinet front consisting of:

1. A key-operated selector switch to provide the following positions and functions:

a) Test - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.

b) Normal - Normal operating position.

c) Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.

G. Transfer switch position and source available lamps.

H. Sequence of Operation for ATS #6

a) Upon loss of normal power, a signal shall be sent to the ERVs to lockout the compressors during emergency power mode.

2.4 ACCESSORY ITEMS (Transfer switches shall be equipped with accessories as follows):

A. Meters: Provide an AC Voltmeter, an Ammeter, and a Frequency meter; minimum 0.1% accuracy. Provide a phase selector switch to read L-L voltage and current of both power sources.

B. Auxiliary contacts:

1. 14A/14B

a) Additional auxiliary contact sets to indicate switch position. Two sets are supplied as standard on 4000 series switches.

2. 18Z

a) One form C contact (rated 2A@30VDC, 0.5A@125VAC) for each normal and emergency source availability, plus one form C contact wired to feature 31 Group 5 controller output (see PDS-042 for feature 31 description), plus one programmable additional relay.

3. 31Z

a) Selective load disconnect circuit to provide a pre-transfer and/or post transfer signal when transferring from emergency to normal and/or

normal to emergency. The signal can be programmed to occur during all transfers or only when the transfer is occurring between two live sources. The length of the pre and post transfer delays can be set to 0-5 minutes 59 seconds.

C. Provide ASCO's 5210 Power Quality meter (acc 135L) for on switch metering and data for:

1. Power (kW, kVA & kVAR) & Power Factor
2. Total Harmonic Distortion (%)
3. Energy (kWh, kVAh & kVARh)
4. kW Demand

D. Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period.

3 EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Equipment shall be permanently fastened in place in accordance with manufacturer's instructions and seismic requirements of the site.

D. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

3.2 TESTS

A. Equipment shall be initially started and operated by representatives of the manufacturer.

B. Factory Tests: Equipment supplied shall be fully tested at the factory for function and performance.

C. On-Site Acceptance Test: The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer. The Engineer shall be notified in advance and shall have the option to witness the tests.

D. Installation acceptance tests to be conducted on-site shall include a minimum of ten (10) operations of switches under load in accordance with requirements of NFPA-110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

3.3 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

END OF SECTION

SECTION 264313 – TRANSIENT VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Externally-Mounted Surge Protection Device (SPD); complete, including all materials, components and associated accessories and having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings.
2. The terms “Surge Protection Device” (SPD), “Surge Protective Device” (SPD), and “Transient Voltage Surge Suppressor” (TVSS) may be used interchangeably either herein or on the drawings and shall have the same meaning.
3. Surge protection devices are intended for protection of building electrical and electronic systems from the effects of line and electromagnetic induced transient voltage surges and coupled lightning discharged transients.

1.2 QUALITY ASSURANCE

A. The surge protection devices and associated accessories shall be designed, manufactured, installed and tested in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA) LS-1 (or replacement standard)
3. American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE):
   a) C62.11
   b) C62.41
   c) C62.45
4. Underwriters Laboratory (UL):
   a) UL 1020
   b) UL 1283
   c) UL 1449 3rd Edition

B. For the equipment specified herein, the manufacturer shall be ISO 9000 certified.

C. All Surge Protective Devices shall be of the same manufacturer.

D. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list

of installations with similar equipment shall be provided demonstrating compliance with this requirement.

E. The manufacturer must have a 24-hour response capability with field engineering personnel. The field service organization must have fully accredited, power system technicians/engineers who are capable of performing complete grounding, power quality analysis, and coordination studies. Factory trained sales personnel do not qualify as power system technicians/engineers.

F. Equipment Certification: Items shall be "Listed" by Underwriters Laboratories, Inc. and shall exhibit the UL Listing Mark for the category "Surge Protective Devices" or SPDs. UL Listing Card shall be provided to confirm compliance to UL 1449 4th Edition) Standard and assigned Voltage Protection Ratings.

1. "Manufactured in accordance with" is not equivalent to UL Listing and does not meet the intent of this specification.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Descriptive bulletins; include UL 1449 (4th Edition) Listing documentation, verifying: short circuit current rating (SCCR); voltage protection rating (VPR) for all modes; maximum continuous operating voltage (MCOV) rating; I-nominal rating (I-n).
2. Product sheets; include dimensional drawings and indicate mounting arrangements.
3. Manufacturer's installation instructions.
4. Upon request, following additional information shall be submitted to the engineer:
   a) Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41Category C3 & C1 (combination wave) and A1 (ringwave) tested in accordance with ANSI/IEEE C62.45.
   b) Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 10 kHz and 100 kHz verifying the devices noise attenuation equal or exceeds 40 dB at 100 kHz.
   c) Provide test report from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Test data must be on a complete SPD with internal fusing in place; test data on an individual module shall not be accepted.

1.4 WARRANTY

A. The surge suppressor manufacturer shall warrant the surge protective devices and supporting components against defects in material and workmanship for a minimum period of ten (10) years with a (5) year in the field labor warranty.

B. Any surge protective device, which exhibits evidence of failure or incorrect operation during the warranty period, shall be repaired or replaced by the manufacturer.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Recommended renewal parts list
3. Final as-built drawings
4. Manufacturer's executed warranty

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. ASCO Surge Protection (Basis of Design)
2. All others must submit 25 days prior to bid for pre-approval

B. All components shall be the product and assembly of the same manufacturer, or equivalent products of a number of manufacturers, which are suitable for use in a unified system.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements:

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration. SPDs shall provide suppression for both normal mode (L-N) and common mode (L+N-G) protection unless noted otherwise.
2. SPD shall be UL labeled with a 200kA Short Circuit Current Rating (SCCR).
   a) Fuse ratings shall <u>not</u> be acceptable in lieu of demonstrated withstand testing of SPD per NEC 285.6.
3. SPD shall be UL labeled with 20kA I-nominal (I-n) rating for compliance with UL-96A, Lightning Protection Master Label, and NFPA-780.
4. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be a minimum of 150V for 120/208V systems; and 320V for 277/480V systems.
5. The suppression system shall incorporate a parallel-operated hybrid circuit design and include full cycle tracking clamping capability. The system shall not utilize gas tubes, silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

6. Suppressors shall exhibit redundant protection for each phase, consist of solid-state components and operate bi-directionally.

7. Protection Modes – For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).

8. UL 1449 (4th Edition) Voltage Protection Rating (VPR) – The maximum VPR for the device must not exceed the following:

MODES	208Y/120	480Y/277
L-N	700V	1000V
L-G	700V	1200V
L-L	1000V	1800V
N-G	700V	1000V

9. Nominal Discharge Current – Nominal discharge current testing per UL 1449 (4th edition) shall be performed in conjunction with manufacturer's VPR tests. Test every mode of protection, including any required overcurrent protection, and certify compliance.

10. Minimum surge current capability (single pulse rated) shall be 300kA/phase, 150kA/mode for service entrance locations, including transfer switches; 200kA/phase, 100kA/mode for distribution panels and motor control centers; and 130kA/phase, 65kA/mode for branch circuit panelboards.

B. TVSS Design:

1. 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. The SPD shall have a minimum of 7 MOV's per mode of protection.

2. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.

3. Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall provide high frequency noise filtering up to 50 dB attenuation (100 kHz – 100 MHz).

4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings. Current carrying pathways shall be low impedance bus bar construction. Module connections shall be of bolt down connection to the bus bar.

5. Standard Monitoring Diagnostics – Each TVSS shall provide integral monitoring options:

   a) Each unit shall provide a solid state visual indicator on each phase that shall indicate which phase(s) have been damaged. The indicator shall consist of an LED array for each phase of protection; no single LED or neon indicators will be used.

   b) Remote Status Monitor – The TVSS device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.

   c) Audible Alarm – The TVSS shall provide an audible alarm with a reset pushbutton that will be activated under any fault condition. A silence button shall be provided for the alarm.

   d) Event Counter – The TVSS shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event counter triggers each time under each respective categories after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.

   e) Push to Test – The TVSS shall be equipped with push-to-test feature that is designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. By depressing the test button, the diagnostic system initiates a self-test procedure. If the system is fully operational, the self-test will activate all indicator lights.

   f) Voltage Monitoring – The TVSS shall display true Root Mean Square (RMS) on three L-N voltage protection mode on Wye configuration and three L-L voltage on delta configuration.

6. Overcurrent Protection Fusing: In order to isolate the SPD under any fault condition, the manufacturer shall provide:

   a) Individual Fusing: MOV's shall be individually fused via Silver Link Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.

   b) All overcurrent protection components shall be tested in compliance with UL 1449 Limited Current Test and AIC rating test.

7. Suppressor shall be mounted in a NEMA 4 enclosure.

2.3 SYSTEM APPLICATION

A. The TVSS applications covered under this section include switchgear, switchboards, motor control centers (MCC's), busways, distribution and branch panelboards.

B. SPDs shall be of the applicable Type as defined by UL-1449 (4th Edition) for the following locations:

   1. Service Entrance Locations – Type 1.

   2. High Exposure Roof Top Locations – Type 1.

3. Branch Locations – Type 1.

C. Surge Current Capacity - The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

Minimum total surge current and withstand Capability with compliance to ANSI/IEEE C62.41 AND NEMA LS1			
APPLICATION	Per Phase	Per Mode	Surge Withstand Capabilities ANSI/IEEE C3 Wave (10 kA)
Service Entrance Locations (Switchboards, Switchgear, MCCs, Main Panelboards)	300kA	150kA	12000
High Exposure Roof Top Locations (Distribution Panelboards)	200kA	100kA	12000
Branch Locations (Panelboards, MCCs, Busway)	130kA	65kA	12000

D. Switchgear, Switchboard, MCC, Busway, Distribution and Branch Panelboard Requirements:

1. The SPD shall not limit the use of Through-feed lugs, Sub-feed lugs and Sub-feed breaker options, etc.

2. Connect the SPD to a circuit breaker on the load side of the main overcurrent protection device. Locate the SPD connection and as close as possible to the circuit being protected to minimize the wire length and optimize SPD performance.

3. To reduce the impedance of the SPD conductors, the phase, neutral, and ground conductors must be routed within the same conduit and tightly bundled or twisted together.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 260500 and manufacturer's recommendations.

B. Surge Protective Devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association codes and standards. Devices at service entrance location shall be installed on the load-side of the main service disconnect.

C. To maximize performance and reliability, mount the SPD/TVSS as close as possible to the equipment protected (i.e. panelboard, switchboard, etc.). Keep conductors as short and straight as possible. Conductor lead length between breaker and suppressor shall be less than 18 inches, for secondary distribution panels; and less than 36 inches, for service entrance locations.

D. Minimum conductor size shall be #6 AWG stranded, copper; pre-wired suppressors with conductors smaller than #6 AWG shall not be acceptable.

E. Make connections in accordance with SPD manufacturer's recommendations. Provide a 30A/3P circuit breaker in associated panel as the point of connection/SPD disconnecting means.

3.2 TESTS

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

END OF SECTION

SECTION 265113 – LIGHTING FIXTURES, LAMPS AND BALLASTS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior and exterior luminaires (fixtures) and lamps; complete, including all necessary installation hardware and associated accessories; including ballasts / drivers.

1.2 QUALITY ASSURANCE

A. The luminaires, lamps and associated accessories shall be designed, manufactured, installed and tested in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Underwriters Laboratory (UL) listed and labeled.
4. Certified Ballast Manufacturers Association (CBM)
5. American National Standards Institute (ANSI)
6. Federal Communications Commission (FCC)
7. Illuminating Engineering Society of North America (IESNA)
8. Federal Energy Policy Act of 2005 (EPAct 2005)

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Luminaire product data sheets. Data sheets shall include sufficient information to determine compliance with the drawings and specifications. Information shall at minimum include the following: electrical ratings, dimensions, mounting details, any clearance requirements, wiring/connection diagrams, photometric data upon request, ballast information, pole data, etc.
2. Complete listing of all lamps by manufacturer, including type, color temperature (Chromatisity), color rendering index (CRI) and catalog number. The listing shall cross-reference each fixture type to indicate the particular lamp being provided for each fixture.
3. Submittal shall include Ballast/Driver product data.
4. Submittal shall include a photometric plan (if substitutions are submitted for review; per 1.3(B).
   a) Signed Letter from manufacturer/supplier.

B. Substitutions (Fixtures other than the basis of design):

1. Decorative fixtures may be rejected based on their appearance.
2. Fixtures may be rejected based on their performance.
3. Contractor shall provide complete photometric design for the entire building and site.
    a) Submit full size drawings denoting the footcandle readings.
    b) Drawing shall include the following:
        1) Floor plans/drawings to match the layout of the construction drawings; showing the lighting layouts. Site plan showing the entire site with the fixtures located on the plans.
        2) Indicate light loss factors (LLF) and Room Cavity Ratios / reflectance's (RCR) in the calculations; utilize these numbers for calculations:
            a. Fluorescent lighting: 0.8 LLF
            b. LED lighting: 0.9 LLF
            c. RCR / Reflectance's: Ceiling 80%, Wall 50% and Floor 20%
        3) Provide a schedule that denotes each room with the max/min and average of the footcandles within that space.
        4) Footcandle reading shall be spaces at 3'x3' grind for interior spaces; 4'x'4 grid for site plan. Or shall be legible based on the scale of the drawing.
4. Photometric plan shall be performed <u>PRIOR TO</u> releasing an order for any lighting.
5. Watts per square foot calculations: Contractor shall provide complete list/chart of fixtures with the actual wattage of each fixture (Interior and exterior) and / or provide a completed COMcheck.
    a) Chart shall include the following (for interior fixtures and exterior):
        1) Fixture Tag; same name as listed in the fixture schedule
        2) Lamp / LED description (wattage of lamp(s) or LED array
        3) Ballast / Driver type
        4) Lamps / LED Array per fixture
        5) Overall Fixture Wattage
        6) Number of fixtures (per each fixture type)
    b) The Interior wattage chart shall also include:
        1) Overall building square footage
        2) Allowable watts per square foot in accordance with IECC (table 505.5.2)
        3) Calculation showing that the substitution fixture package will comply with the allowable watts per square foot in accordance with IECC.

c) The Exterior chart shall also include:

1) Exterior lighting area (where the fixture is being utilized); Designation per IECC.

2) Area description

3) Quantities of fixtures in that area

4) Units/lighting power allowances per exterior zone (reference IECC, Table 505.6.2(2)).

5) Watts per unit

6) Denote if space is tradable or non-tradable

6. Lighting package may be rejected based on the results of the photometric plans and/or the allowable watts per square foot results that do not comply with applicable codes.

7. Submit photometric plan for Engineer's review/approval prior to receiving final approval of lighting fixtures. Include as part of the lighting fixture submittal.

8. Pre-Approval of a manufacturer and/or proposed lighting fixture for bidding does not constitute Final shop drawing/submittal approval; nor does it guarantee same. Engineer reserves right to review and approve, comment on, or reject any and all proposed equipment during required submittal process, after award of contract, regardless of manufacturer being named Acceptable or Pre-Approved.

9. Substitution submittals will require up to 3 weeks for engineer's review. Contractor shall factor the timeframe into the construction schedule as not to delay the project.

a) A signed letter from the manufacturer and/or supplier denoting there will be no delays in supplying the fixtures on time and not to delay the project; given the timeframe for adequate engineer's review of the submittal and subsequent reviews (as necessary) to submit an "Approved" submittal package.

10. The basis of this portion of the contract is for a maximum of one (1) substitution review of any submittal by the Engineer. If additional reviews of a submittal are required for approval, the Contractor shall compensate the Engineer for additional process charges.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Luminaires: See the lighting schedule on the drawings for the basis of design.

2. Lamps:

a) General Electric

b) Osram Sylvania

c) Philips

3. Ballasts:
   a) Advance
   b) General Electric/Magnetek
   c) Universal
4. LED Drivers:
   a) Lutron
   b) Advance
   c) Universal

2.2 LUMINAIRES (INTERIOR AND BUILDING MOUNTED)

A. The type and wattage of each fixture is noted on the drawings. If type and wattage are omitted on any outlet, a fixture of the type and size specified for a similar location shall be furnished and installed or should be called to the Architect's attention before final bidding date.

B. Fixtures located on exterior of building or in areas where exposed to water or dampness shall be waterproof and gasketed, suitable for location in which installed. All metal screws and frame shall be non-ferrous metal.

C. All fixtures shall be of such design that no light leaks will be encountered after installation of fixture in place. Any modifications of fixtures necessary to achieve same shall be done at this Contractor's expense.

D. Unless otherwise hereinafter specified, trims for recessed fixtures shall be finished in baked white enamel. The finishes of all surface, suspended or wall mounted fixtures shall be as selected by the Architect.

E. Check and verify the various ceiling types with Architect and General Contractor. This Contractor shall be responsible for ordering the correct type lighting fixture with all associated hardware, mounting accessories and trims, for accommodating the type ceiling in which light fixtures are to be installed, regardless of catalog numbers specified.

F. All recessed incandescent fixtures shall be equipped with a thermal resetting device, in compliance with UL 1571 and the National Electrical Code. Such device will open in the event of fixture over-heating and cause the fixture to cycle off. Upon cooling of the fixture, the device will close and re-energize the fixture.

G. Where plastic diffusers are utilized, they shall be 100% virgin acrylic unless otherwise specified.

H. This Contractor shall be responsible for ordering the correct quantity of fixtures at the voltage as indicated on the drawings by circuiting - not the catalog number. Catalog numbers are indicated to establish the quality, type and style to be provided.

I. Fixture quantities shall be as shown on the electrical drawings.

2.3 FIXTURES WITH CENTER "SPLINE"

A. Coordinate center spline direction with architect/engineer prior to rough-in.

1. Show direction of spline on coordination drawings.

B. Unless otherwise note, the spline for 2x2 fixtures located in corridors shall be perpendicular to the corridor walls.

2.4 FIXTURES INSTALLED IN FIRE RATED ASSEMBLIES

A. All lighting fixtures installed in or penetrating new or existing fire rated assemblies (ceiling systems) shall bear the appropriate fire rating. This contractor shall be responsible for ordering the correct type lighting fixture for accommodating the type ceiling in which light fixtures are to be installed, regardless of catalog numbers specified.

B. Alternately, and at the contractor's option or as noted on the drawings, contractor may provide membrane-penetration fire barrier systems, for use with standard (non-rated) lighting fixtures and that are produced and installed to resist the spread of smoke, gases and fire according to requirements indicated, maintaining the fire-resistance rating of the construction/assembly penetrated or in which the fixture is installed.

C. Membrane-penetration fire barrier systems shall be compatible with the structure and in compliance with structural systems and clearances required by the manufacturer. Designed penetrations of the fire barrier system shall be only as supplied by the manufacturer. Penetrations of the membrane fire barrier shall be allowed for power wiring as described on the written manufacturer's installation instruction sheet.

1. Power wiring shall meet the requirements of these specifications, the NEC and authority having jurisdiction.

2. Penetrations of membrane fire barrier systems shall only be made at factory-designated knock-out locations and/or in conformance with manufacturer's instructions.

3. A maximum of two standard ¾" conduit penetrations (or equivalent) shall be allowed per enclosure, or as otherwise limited by the manufacturer.

D. Acceptable Manufacturers: (subject to compatibility with ceiling system in which installed)

1. E.Z. Barrier

2. Tenmat, Inc.

2.5 SITE LIGHTING LUMINAIRES, AND FOUNDATIONS

A. Luminaires:

1. Luminaires shall be weatherproof, heavy duty, and designed for adequate heat dissipation of lamp/ballast heat.

2. Light distribution pattern shall be as shown on the drawings or otherwise shown on manufacturers data sheets of specified fixture.

3. Incorporate ballasts in the luminaire housing unless otherwise noted.
4. Lenses shall be frame mounted and heat resistant. Frame shall be attached to the luminaire housing by hinges, chain, or cable.
5. Utilize heat and aging resistant gaskets to seal removable parts of the luminaire.
6. Materials shall be rustproof – latches and fitting shall be non-ferrous metal.

B. Poles:

1. Poles shall be as specified on the drawings (height, shape, and type of metal). Final color selection shall be per architect.
2. Poles and arm assemblies shall be designed for wind loading of 80 miles per hour with an additional 30 percent gust factor. Specified poles shall be increased in size where necessary to comply.
3. Poles shall be anchor bolt type designed for use with underground supply conductors.
4. Poles shall have a hand hole having a minimum clear opening of 1.5” x 5”. Hand hole cover shall be secured by stainless steel captive screws.
5. Provide a steel grounding stud opposite hand hole openings.
6. Provide a base cover matching the pole material and color to conceal the mounting hardware and anchor bolts.

C. Foundations:

1. Electrical Contractor shall provide a concrete cast-in-place foundation for each site lighting pole. Foundation shall incorporate rebar.
2. In general, pole foundations in the immediate vicinity of parking areas shall extend 36” above finished grade and in grass areas, pole foundations shall extend 6” above finished grade.
3. In general, pole foundations for poles 20’ and lower shall be 18” in diameter and shall extend 5’ below finished grade and pole foundations for 25’ poles shall be 22” in diameter and shall extend 5’ below finished grade.
4. All exposed areas of concrete foundations shall have a concrete rubbed finish.
5. Provide 1” chamfer around top of foundation.
6. Install minimum 36” long galvanized steel anchor bolts (threaded at the top and bent 90 degrees at the bottom) in concrete for support of pole and luminaire(s). Exact bolt pattern of pole shall be determined prior to concrete pour.
7. Underground conduits providing power to pole shall be installed inside the pole foundation and shall extend to 1” above the foundation and shall be concealed when pole and base cover are installed.
8. Each pole base shall have a spare 1” conduit installed from top of foundation to 30”below grade (concrete encased and capped) for future use.

2.6 LAMPS

A. Furnish and install fluorescent lamps of the sizes and types as required to fit each socket and fixture. Lamps shall be rated at 120 volts or in accordance with the fixture operating voltage.

B. Basis of design compact fluorescent lamps shall be low mercury content General Electric Ecolux (SPX35/ECO) series having a minimum CRI of 82, color temperature of 3500K, suitable for operation with electronic ballasts or as otherwise specified. Minimum rated life shall be 12,000 hours (20,000 hours w/ 12 hour start).

C. All lamps to be dimmed shall be coordinated with the dimming ballast manufacturer and shall be supplied with pin configuration per the manufacturer.

2.7 BALLASTS

A. All fluorescent fixture ballasts shall be electronic, instant start, high frequency, full output type. All ballasts shall be UL-Rated, ETL certified, Class P, high power factor, parallel wired and have an "A" sound rating. Ballasts shall have less than 20 percent total harmonic distortion, a minimum ballast factor of 0.95 and a nominal power fact of 0.90. Dimming ballasts shall be approved for use with dimming system controllers specified. Line voltage shall be as indicated by the circuiting as shown on the drawings.

2.8 LED LUMINAIRES AND DRIVERS

A. LED Luminaires

1. Comply with IES LM-79 Approved Method for measuring lumen maintenance of LED light sources.
2. Comply with IES LM-80 Approved Method for electrical and photometric measurement of SSL product.
3. LED’s shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
4. LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.
5. LED luminaires shall deliver a minimum lumens per watt equal to (or exceeding) the basis of design.
   a) LED’s shall be “Bin No. 1” quality.
6. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
7. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.
8. Luminaires shall have internal thermal protection.
9. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

10. Color spatial uniformity shall be within .004 of CIE 1976 diagram.
11. Color maintenance over rated life shall be within .007 of CIE 1976.
12. Indoor luminaires shall have a minimum CRI of 85.
13. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management
14. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.
15. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.
16. LED fixtures shall be Energy Star or Design Light Consortium Listed.

B. LED Power Supplies and Drivers:

1. Power Factor: 0.90 or higher
2. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
3. Output operating frequency: 60Hz.
4. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
5. Total Harmonic Distortion Rating: 20% Maximum.
6. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
7. Primary Current: Confirm primary current with Drawings.
8. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
9. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
10. Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

C. All fixtures indicated as being dimmer controlled shall be provided with a dimmer controllable driver.

1. 0-10V dimming lighting controls: Where dimming ballast is integrated into the digital lighting control system or 0-10V dimming is indicated the compatible ballast shall be provided with 0-10V capabilities; 100% to 1% dimming. The basis of design shall be the Eco-System Ballast as manufactured by Lutron (or comparable ballast that is compatible with the lighting control system).

D. All fixtures indicated as being step-dimmer controlled shall be provided with a step-dimmer controllable ballast.

1. The basis of design shall be manufactured by Universal/Advance. Step-Dimming driver and dimmer combination shall allow 100% to 50% to off level control.

E. Where as noted in drawings and/or specifications the intent is to have the lighting control system, lighting controls and associated ballast to be compatible.

2.9 FIXTURE DESIGNATIONS

A. The first letter "R" for recessed, "S" for surface or suspended, "W" for wall, “P” for pendant. The second letter(s) denotes type and numeral(s) generally indicate total lamp wattage. This does not apply in all cases.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 260500 and manufacturer’s recommendations.

B. Lamps:

1. All inoperable lamps shall be replaced with new lamps during the course of construction, up to and including the date of final acceptance of the building by the Owner.

C. Fixtures:

1. Fixture and/or fixture outlet boxes shall be provided with hangers to adequately support the complete weight of the fixture. Special hanger systems shall be furnished where required. Provide all necessary additional auxiliary supporting steel for fixtures not mounted on building framework, and where necessary to span the ceiling channels of hung ceiling construction. Fixtures mounted on outlet boxes shall be rigidly secured to a fixture stud in the outlet box. Hickies or extension pieces shall be installed where required to facilitate proper installation. Unless otherwise directed, all pendant fixtures within the same room or area shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during installation.

2. Fixtures installed in suspended ceilings shall be securely fastened to the ceiling framing members by mechanical means and or approved clips as required by the National Electrical Code.

3. Coordinate exact luminaire mounting heights and locations with architectural plans and elevations.

4. The contractor shall position lighting for mechanical spaces, elevator pits and other similar rooms for optimum illumination of the space in consideration of field conditions and other trade work. The contractor shall temporarily power and mount or position fixtures at location of optimal illumination. Final location of fixture shall be coordinated with the AHJ, inspection agency or inspector as required to satisfy their judgment. Then and only then shall the fixture be permanently mounted in its final position.

5. Building mounted exterior lighting shall be located symmetrically about architectural features of the building exterior.

D. Site Lighting Luminaires, and Foundations:

1. Foundation excavation: depth shall be as required. Dig holes large enough to permit proper use of tampers to the full depth of the hole. Place backfill in the hole in 6” maximum layers and thoroughly tamp.

2. Adjust poles as necessary to provide a permanent vertical position.

3.2 FIELD ADJUSTMENTS

A. Contractor is responsible to adjust the aiming of luminaires as required to obtain optimum lighting levels.

B. Final Cleaning:

1. Contractor is responsible for cleaning interior and exterior Luminaires, including fixture body, lenses, louvers, etc., of dirt and construction debris upon completion of installation and prior to acceptance by owner.

END OF SECTION

SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Basic Requirements specifically applicable to all Division 27 – Communications sections; in addition to the General and Supplementary Conditions of Contract, and Division 01 - General Requirements, applicable conditions of which are hereby incorporated by reference.
2. General Requirements:
   - a) Intent
   - b) Responsibility of Bidders
   - c) Quality Assurance
   - d) Products
   - e) Submittals
   - f) Substitutions
   - g) Guarantees
   - h) Applicable Publications
   - i) Regulatory Requirements
   - j) Project/Site Conditions
   - k) Delivery, Storage and Handling
   - l) Sequence and Scheduling
   - m) Interruption of Services
   - n) Temporary Electrical Service
   - o) Demolition
   - p) Cutting and Patching
   - q) Hazardous Materials
   - r) Operating and Maintenance Manuals
   - s) Record Drawings
   - t) Cleaning
   - u) Painting
   - v) Electrical/Mechanical Sound Control
   - w) Final Acceptance
   - x) Owner Instruction
3. Products:

a) Vibration Isolators

b) Pipe Curbs; Equipment Supports; and Flashing

c) Firestopping

d) Electrical Identification

e) Access Panels

B. Related Sections:

1. General Conditions and Supplementary Conditions of Contract.
2. All sections of Division 01 – General Requirements (as applicable).
3. All sections of Division 27 – Communications.

1.2 INTENT

A. Provide complete and fully operational Communications systems with facilities and services to meet all of the requirements described herein and in complete accordance with all applicable codes and ordinances.

1. The term “provide”, as used in these specifications and on the drawings, shall be understood to mean “furnish and install, complete and operational, with all required hardware, accessories and appurtenances.” Unless indicated otherwise, this shall also include all associated power and/or signal wiring required for electrical systems furnished under this Contract.
2. The manufacturer's recommendations for the particular equipment or system, the National Electrical Code and the Architect/Engineer shall determine what is the complete and proper installation and proper operation.

B. Provide all temporary services and/or equipment as required for all installations.

C. Protect all equipment installed under this contract, until final acceptance of the project.

D. Test all equipment installed under this Contract and adjust the operation of such equipment, leaving all systems in perfect operating condition.

E. Upon completion of the work, thoroughly clean all equipment, leaving the job site and installation in first-class condition.

F. The drawings are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and quality and are not detailed installation instructions.

G. The Contractor will be held responsible for proper installation of materials and equipment to true intent and meaning of both Drawings and Specifications. All items of labor, material and equipment not specified in detail or shown on the drawings, but incidental to or necessary for the complete installation and proper operation of the several branches of work described herein or depicted on the drawings; or reasonably implied in connection therein; shall be provided as if called for in detail by the Drawings and/or Specifications.

H. In cases of discrepancies between drawings, or between the drawings and the specifications, the Engineer will make the final determination as to which is correct. In

cases where items appear in the specifications but not on the drawings, or appear on the drawings but not in the specifications they shall be considered as noted on both. Unless written clarification in the form of an addendum is received, the bid shall be interpreted to include the most expensive installation, equipment or work and all associated costs.

I. The Engineer reserves the right of interpretation of the specifications and drawings. The Engineer's decisions of interpretations shall be final.

1.3 RESPONSIBILITY OF BIDDERS

A. Examine all contract documents issued. Visit the site and become thoroughly acquainted with the existing conditions prior to submitting a proposal. The submission of a proposal shall be considered as evidence that a site visit was conducted; no extra compensation will be allowed for any error resulting from failure to visit job site. Prior to submitting a proposal, bidders must familiarize themselves with the codes, rules, and regulations in effect at the site of the work, to determine existing conditions that affect their installation.

B. Carefully examine the Architectural; Structural; Heating, Ventilating and Air Conditioning; Plumbing; Fire Protection; Electrical; Technology Systems and/or Miscellaneous Contract Drawings and Specifications. If any discrepancies occur between the drawings or between the drawings and specifications, report such discrepancies to the Architect in writing and obtain written instructions as to the manner in which to proceed. Do not make departures from the Contract Drawings without prior written approval of the Architect.

C. The terms "Communications contractor", "Technology contractor", "the contractor" and "this contractor", mentioned in these Division 27 - Communications specifications and on the drawings, refer to the Contractor responsible for all work and equipment included in the Division 27 - Communications specifications.

1. Subcontractors: Any reference to, or letting of work contained in these specifications to, any Subcontractor or Manufacturer does not relieve this Contractor of his responsibility for all work, material and equipment in this specification.

D. In all cases where equipment and materials are specified in the singular or plural number, assume that such references shall apply to as many such items as are required to complete the installation.

E. Execute all work, construct and install all equipment in accordance with the current requirements of all Occupational Safety and Health Administration (OSHA), National Fire Protection Association (NFPA), the National Electrical Code (NEC) as amended to date, Underwriters Laboratories (UL), National Electrical Manufacturers Association (NEMA), owner's insurance underwriters and/or other authorities having jurisdiction over premises, public utilities which have connection with any systems specified, and all Federal, State, County and Local ordinances and regulations. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with the aforesaid codes, ordinances, or regulations. Contractor shall be held responsible for accident to persons, material or property caused by failure to adhere to the proper code requirements until the Owner has accepted work.

F. Contractor shall be qualified or licensed to perform the types of work involved under this Division of the Specifications in the state, county and/or municipality of this project as required.

G. Secure and pay for all permits, inspections and approvals required by foregoing authorities in connection with all work specified herein, unless otherwise noted. All costs associated with permits, inspections and approvals shall be included in the contract price unless directed otherwise. Obtain certificates of approval from departments responsible for issuing same. Deliver certificates in triplicate to the Architect/Engineer, at which time they shall become property of the Owner.

H. Wherever any installation, product, equipment item, etc. specified herein is not permitted to be handled or installed, or is otherwise restricted by union regulations, etc., notify the Engineer in writing before submitting a bid, in ample time for modifications in the requirements to be made. If such notification is not given, this Contractor shall be responsible to complete the installation as specified, to the Engineer's satisfaction and at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least three years. See applicable specification sections for any additional requirements.
2. Equipment Service: Products shall be supported by a service organization that maintains a complete inventory of repair parts and is located reasonably close to the site.
3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
5. Nameplates: Nameplates bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
6. Underwriter's Labels: Where applicable, all material and equipment shall bear the label of approval of the Underwriter's Laboratory, Inc.

B. Manufacturer's Recommendations: Install materials in accordance with manufacturer's recommendations. Provide all required hardware, accessories and appurtenances as recommended by the manufacturer to complete the intended installation and function, even though such items may not be specifically called out or detailed on the drawings or in the specifications.

1. The term "manufacturer" as used in these Specifications or on the Drawings shall be understood as applying to a company of established reputation in the

manufacture of the particular equipment, system or apparatus from products of their own make or others; and who assumes full responsibility for products utilized in said outfits, which are not manufactured by them.

C. The Contractor is responsible for the means, methods, techniques, sequences, and procedures of construction and for worker safety.

1.5 PRODUCTS

A. Products, if any, named on the Contract Drawings or documents, and products of manufacturers named first throughout the Project Manual and/or documents, generally constitute the Engineer's Basis of Design, whether or not specifically denoted as such.

B. Products of named manufacturers appearing throughout the Project Manual and/or documents, or on the Contract Drawings or documents, other than the first named manufacturer, are accepted as Equal; however the requirements of the General Conditions regarding equipment shall apply.

C. Where three or more (Acceptable) Manufacturers are named, either in the specifications or on the drawings, contractor shall provide products by one these manufacturers only. Where fewer than three (Acceptable) Manufacturers are listed, and unless specifically indicated otherwise, contractor shall assume the phrase "Or Equal" and may submit standard product of any manufacturer, subject to compliance with these specifications and acceptance or Approval by the Engineer/Architect.

D. If products of manufacturers, other than those named first, differ from those named first in the Project Manual and/or documents, or on the Contract Drawings or documents, to the extent that their proper incorporation into the work requires changes to structural, piping, mechanical, electrical, and/or instrumentation work, or any other changes whatsoever in nature is required; then this Contractor shall be responsible for all such change(s) and all associated cost(s).

E. Thus, if the Contractor provide equipment other than the Engineer's Basis of Design, then the Contractor shall be responsible for all costs, by all trades, as required to accommodate the equipment provided.

1.6 SUBMITTALS

A. General Requirements Applicable to all Division 27 – Communications specifications:

1. Submit under provisions of Division 01 – General Requirements, and in accordance with the following:

a) Within 30 days after signing the contract, submit to the Architect/Engineer a complete list of proposed equipment and materials, giving the name and address of manufacturer and, when required for proper identification, trade names or catalog numbers. Itemize each type of material and each piece of equipment (omitting duplicates).

b) Submit samples of materials for approval at the site as requested by the Engineer. Such materials may be incorporated into the project after approval and serving their purpose as samples.

c) Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal. Produce shop drawings to indicate fabrication details and proposed layouts for shop or field fabrications as named herein.

d) Mark dimensions and values in units to match those specified. Include contract drawing identification, type, quantities, capacities, accessories, rough-in dimensions, manufacturer's name, model number, connection sizes, wiring diagrams, installation instructions, voltage, phase and amperage, colors, finishes and other pertinent data.

e) Certify, by submittal, that the materials or equipment proposed are satisfactory for the intended application, and that the materials or equipment are in current production with no known plans to cease manufacture.

f) Submittals processed by the Architect/Engineer do not constitute change orders. The purpose of the submittal process is to demonstrate that the Contractor understands the design concept and intent; the Contractor demonstrates this understanding by indicating which equipment and materials he intends to provide and the fabrication and installation methods that he intends to use.

g) If deviations, discrepancies or conflicts between submittals and the contract documents (in the form of design drawings, specifications and addenda) are discovered, either prior to or after submittals are processed by the Architect/ Engineer, the contract documents shall control and shall be followed.

h) Submittals shall bear the Contractor's approval stamp as evidence that he has checked the drawings. Any submittals without this stamp of approval will not be evaluated and will be returned to the Contractor for proper resubmission. Material and equipment reviews by the Architect/Engineer are only for general conformance to the design intent of the project and compliance with information given in the contract documents. Dimensions shall be confirmed and correlated at the job site by the installing Contractor and installation shall be coordinated with other trades. Specifically excluded from shop drawing review are equipment quantities.

i) Coordination composite drawings among the HVAC, Plumbing, Fire Protection, Electrical, Technology, Security and/or Ceiling Contractors are required, with the lead role assigned to the HVAC Contractor. The HVAC Contractor shall prepare ¼" scale drawings with ductwork layout for review by other trades. The other Contractors shall then prepare and provide shop drawings to the HVAC Contractor, who will then prepare final layout and coordination drawings for the project as part of his contract price. The HVAC Contractor shall conduct coordination meetings with all other trades to discuss and resolve interference problems. Once each trade Contractor has initialed the coordination drawings to indicate approval, the HVAC Contractor shall submit the drawings to the Architect for review. The other trade Contractors should finalize their shop drawings in accordance with the coordination drawings, and submit for Architect's review.

j) The basis of this contract is for a maximum of two (2) reviews of any submittal by the Engineer. If additional reviews of a submittal are required for approval, the Contractor shall compensate the Engineer for additional process charges.

k) Electronic versions of the Electrical drawings may be obtained from the Engineer for a nominal fee.

B. Submittals are the contractor's documents; the Architect's and Engineer's approval constitutes an acknowledgment that the documents have been submitted and nothing more. It is the contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

C. Material and equipment reviews by Architect and/or Engineer are only for general conformance with the design concept of the project and compliance with information given in the Contract Documents. Specifically excluded from the Engineer’s shop drawing review are material quantities, connection details, mounting trim, etc.

D. The Contractor is solely responsible for providing materials in conformance with the Contractor Documents. Dimensions shall be confirmed and correlated at the job site by the installing Contractor and installation shall be coordinated with other trades. Shop drawing approval does not modify the Contractor’s duty to comply with the Contract Documents.

1.7 SUBSTITUTIONS

A. Refer to Division 01 – General Requirements.

B. Pre-Bid substitutions will not be accepted during the bidding phase. Bids shall be based on the products as indicated on the contract documents and specifications. Any substitutions shall be submitted by the contractor for review and approval by the engineer during the submittal process.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalog number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, assume the phrase "or approved equal", except that the burden is upon the bidder to prove such equality.

D. If the bidder elects to prove such equality, he shall request, in writing, review of the substitution by the Architect/Engineer in accordance with all Supplementary Conditions and/or Division 1 requirements. All such requests shall include manufacturer’s literature, specifications, drawings, catalog cuts, performance data or other references or information necessary to completely describe the item.

E. The Contractor shall be responsible for all structural, mechanical, and electrical changes required for their installation, at no additional cost to the Owner.

F. A substitution request constitutes a representation that the Contractor:

1. Has investigated the proposed product and determined that it meets or exceeds the quality level of the originally specified product.

2. Will provide the same or greater warranty than the originally specified product.
3. Will coordinate the installation and make changes to all other work including coordination and compensation to other trades which may be required for the substituted product to be installed with no additional cost to the Owner.
4. Waive claims for additional costs or time extensions, which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

G. Whenever this contractor desires to furnish equipment of a manufacturer other than that specified or intended; the contractor shall include a complete specification of the substituted item along with each submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the contract specifications. Manufacturer's verification specifications shall be written as close as possible over the contract specifications so that an accurate comparison can be made.

H. The verification specification shall include the exact wording of the contract specification and the revised wording, identified properly, indicating all the deviations proposed. If no deviations are noted, the contractor shall furnish the material or equipment in accordance with the contract specifications.

I. Substitutions will be considered when a product becomes unavailable through no fault of the Contractor.

J. Also, when the contractor submits equipment or materials of the manufacturers specified, verification specifications shall be submitted when requested by the Architect or Engineer.

K. In cases where specific manufacturers are listed, the Engineer reserves the right to consider alternate manufacturers. In all cases where equipment and materials are specified as “Basis of Design”, alternate manufacturers who meet the referenced Standards, these specifications and the standard of quality of the basis of design manufacturer may be submitted for consideration in accordance with the following:

1. It is not the intent of these specifications to be biased or proprietary unless a specific list of (three or more) “Approved Manufacturers” is given or an item is specified as “NO SUBSTITUTIONS”, “NO EQUAL”, etc.
2. The Engineer shall make the final determination of the equality of any proposed alternate manufacturers/equipment.

L. The Architect and Engineer reserve the right of final acceptance of all proposed substitutions.

M. Pre-Approval of a manufacturer and/or proposed system/equipment for bidding does not constitute Final shop drawing/submittal approval; nor does it guarantee same. Engineer reserves right to review and approve, comment on, or reject any and all proposed equipment during required submittal process, after award of contract, regardless of manufacturer being named Acceptable or Pre-Approved.

1.8 GUARANTEES

A. Guarantee all equipment, materials and workmanship and make good any defects in same for a minimum of one (1) year following date of acceptance of the project. Provide additional/special warranties where called for in the technical specifications.

1. Defects determined to be the result of misuse of apparatus by the Owner, his employees, tenants or building occupants shall not be covered by this warranty.

B. Warranty shall be in writing and shall include written copies of factory warranties with expiration dates on items of equipment where warranty date might differ from the acceptance date. No warranty shall start before date of acceptance in writing by the Architect. Repair or replace any defective work developing during this period, at no cost to Owner. Where defective electrical work results in damage to work of other contracts, this contractor shall be responsible to repair and/or restore such work to its original condition, again at no additional cost to Owner.

C. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives, as well as misrepresentations of such data. If the products have been installed in accordance with the manufacturer's published or written instructions and recommendations, and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and all associated work and materials, at no cost to the Owner.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents or applicable codes establish stricter standards.

C. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.

D. National Fire Protection Association (NFPA)

E. International Code Council (ICC)

F. National Electrical Manufacturers Association (NEMA)

G. Underwriters Laboratory (UL)

H. Institute of Electrical and Electronics Engineers (IEEE)

I. American National Standards Institute (ANSI)

J. ADA Accessibility Guidelines for Buildings and Facilities (ADAAG)

1.10 REGULATORY REQUIREMENTS

A. Conform to the latest requirements of the National Electrical Code and the International Code Council Electrical Code. In addition, all applicable Federal, State, Municipal or other authority laws, rules and regulations shall apply.

B. Secure and pay for any and all permits and inspections required by any of the foregoing authorities having jurisdiction, and pay all other costs in connection with the work, unless otherwise noted.

C. Underwriters' Laboratories (UL) listings and National Electrical Manufacturer's Association's (NEMA) stamps or seals shall be evidenced where applicable to electrical apparatus.

D. Conform to applicable regulations of Department of Environmental Protection, Department of Labor and Industry, and OSHA. Comply with applicable safety related work practices described in NFPA-70E.

E. Secure rough-in and final wiring certificates from the Middle Department Inspection Association or other independent inspection agency acceptable to the Engineer. Provide certificates in triplicate and deliver to the Architect prior to project close out.

F. Updated Standards: At the request of the Architect/Engineer, submit a change order proposal where an applicable industry code or standard has been revised and reissued after the date of contract documents and before performance of the work affected. The Architect/Engineer will decide whether to issue a change order to proceed with the updated standard.

1.11 PROJECT/SITE CONDITIONS

A. Refer to Division 01 - General Requirements.

B. Install work in locations shown on the drawings, unless prevented by project conditions.

C. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of the Architect and/or Engineer before proceeding.

D. Perform all minor cutting and patching, and make all changes, relocations and installations with a minimum of noise. All present and new equipment, floors, walls, etc., shall be adequately protected from dust and dirt caused by the work. Protection shall include suitable temporary barriers or coverings. Maintain exterior and interior premises of the building as clean as possible during construction. At no time shall the Contractor interfere with the normal operation of the building by allowing debris, excess earth, etc., to remain on the premises.

E. Generally, inspection and maintenance should only be performed on equipment to which power has been turned off, disconnected and electrically isolated so that no accidental contact can be made with energized parts. Follow all manufacturer's warnings and instructions.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 01 - General Requirements.

B. Deliver materials and equipment to the project site in a clean condition with openings plugged or capped (or otherwise sealed by packaging) both during shipping and during temporary storage. Deliveries shall be scheduled to minimize the amount of time in temporary storage.

C. Delivered equipment crating and/or packaging shall clearly identify pick points or lifting points. In the absence of crating or packaging, pick points or lifting points must be identified on the equipment.

D. When unloading materials and equipment provide special lifting harness or apparatus as may be required by manufacturers. Handle materials and equipment in accordance with manufacturer's written instructions.

E. Determine the required equipment needed for unloading operations and have such equipment on site to perform unloading work on the date of equipment delivery.

F. Store materials on site only where directed by the Owner. Materials and equipment, both on site and off site, shall be stored in accordance with manufacturer's written instructions. Store all materials in dry locations, off ground and keep moisture free at all times.

G. Throughout construction, Contractor shall protect, at his own expense, all work, materials, and equipment furnished and/or installed under this Division. Units and devices both before and after being set in place, shall be securely protected from carelessly or maliciously dropped tools, materials, grit, dirt or any foreign matter. Contractor shall be held responsible for damage so done until work is fully and finally accepted.

H. The Contractor shall be entirely responsible for all apparatus, equipment and appurtenances furnished by him or his subcontractors in connection with the work, taking special care to protect all parts thereof in such manner as may be necessary or as may be directed.

1. Protection shall include covers, crating, sheds or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment.

I. Materials and equipment shall be stored in areas designated by the Owner and/or the General Contractor. Where equipment must be stored outside the building, it shall be totally covered and secured with heavy, waterproof tarps and kept dry at all times. Where equipment has been subjected to moisture, it shall be suitably dried out before being placed in service.

J. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products and equipment to assure that they are being maintained under specified conditions, and free from damage or deterioration.

1.13 SEQUENCING AND SCHEDULING

A. Refer to Division 01 - General Requirements.

B. Interference:

1. The drawings are generally diagrammatic and indicative of the work. The Contractor is responsible for modifying the work with offsets, bends, or other fittings to avoid minor interference's and structural obstructions. Perform such modifications at no increase in cost to the Owner.

2. Construct Communications systems in a manner not to delay or interfere with other operations of work in the project.

3. Prior to making Communications installations, coordinate communications work locations with other operations of work, especially in congested areas such as mechanical rooms and above hung ceilings (if applicable).

4. In the event that interferences develop, the Architect/Engineer's decision shall be final and no additional compensation will be allowed for relocation of work/equipment of this Division - regardless of which work or equipment was installed first.

C. Contract Interface:

1. Work performed in cooperation with other contracts: The responsibility for performing work of this contract in cooperation with work of other contracts rests solely with this Contractor.

a) Prior to rough-in, coordinate exact communications requirements and characteristics for all equipment with contractor furnishing same.

1.14 INTERRUPTION OF SERVICES

A. Refer to Division 01 - General Requirements.

B. At the beginning of the project, review Owner's procedures relating to utility interruptions and plan the work of this Division accordingly. Develop a preliminary utility interruption schedule and submit to the Owner for approval before developing final project schedules.

C. Schedule the work to avoid major interruptions of any systems or services. Interruptions shall be done during overtime or weekend hours, if necessary, at no additional cost to the Owner.

D. Notify Owner's representative a minimum of five (5) working days prior to any interruption of services.

1.15 TEMPORARY ELECTRICAL SYSTEMS

A. Refer to Division 01 - General Requirements.

B. Do not use permanent electrical systems for temporary purposes without prior written permission from the Owner.

C. The use of permanent electrical systems for temporary purposes shall not modify the terms of warranty.

1.16 DEMOLITION

A. The intent is to demolish all work as shown on the drawings and as required for new installations. The drawings are diagrammatic in nature and are intended to represent only the general scope of demolition; neither the demolition drawings or notes shall be considered as all inclusive. The contractor shall review the existing facility, along with the demolition drawings, and shall be responsible to determine the exact extent of the electrical demolition work required to fulfil the intent of the contract documents.

B. This contractor shall disconnect and remove any electrical circuits (120V and above), connections (and associated wiring or conduit) from other trades work that involves electrical connections. Contractor shall reference other trades drawings and determine the exact extent of demolition work required.

C. Perform all demolition work with care and protect portions of the existing installation that are to remain from damage. Damage to existing building equipment, systems, finishes, etc. so incurred shall be repaired by this contractor at no additional cost.

D. Restore damaged or defaced work remaining in place to its original condition.

E. Existing equipment and materials, removal of which is not indicated by the contract documents or required to accomplish the project intent, shall remain unless noted otherwise.

F. Refer to the new work drawings for additional information which may affect demolition work, prior to beginning demolition.

G. Disconnect and remove any ceiling mounted devices that interfere with removal of existing ceiling; store for reinstallation. Retain all associated wring and conduit for reinstallation.

1.17 CUTTING AND PATCHING

A. Refer to Division 01 - General Requirements; Division 07 – Thermal and Moisture Protection; and Division 09 - Finishes.

B. Perform all cutting and patching required for the installation of work under this Division unless noted otherwise. Refer to appropriate sections of Division 09.

C. Perform finishing and roof flashing in areas of existing building or roof not being disturbed under general construction, for installation of work under this Division. Refer to appropriate sections of Division 07.

1. Where openings are to be made in existing roof, obtain bonding company approval, if roof bond is still in effect, before such openings are made.

D. Obtain approval from Owner’s representative before cutting of any existing work or building construction.

E. All existing surfaces shall be repaired and finished to match existing adjacent surfaces.

F. All openings must be neatly drilled, bored or cut in a workmanlike manner, with materials and equipment suitable for the purpose. Punching or chipping of concrete will not be permitted. All openings shall be drilled, bored or cut in a manner satisfactory to and at locations approved by the Architect.

G. Materials damaged under this contract shall be patched or replaced as directed by the Architect.

1.18 HAZARDOUS MATERIALS

A. Refer to appropriate sections of Division 02 – Existing Conditions.

B. Should hazardous or toxic materials be encountered in any existing work, notify the Owner immediately. Do not disturb surfaces or equipment containing hazardous materials without written authorization of the Owner/Architect. All such materials, equipment or components removed by this contractor shall be properly disposed of in accordance with applicable rules and regulations.

C. No known hazardous or toxic materials shall be incorporated into the final construction or any equipment provided under this Contract.

D. Hazardous or toxic materials utilized as a construction aid shall not be stored within the building and shall be removed promptly from the job site when no longer required.

1.19 OPERATING AND MAINTENANCE MANUALS

A. Submit under provisions of Division 01 – General Requirements, and in accordance with the following:

B. Provide heavy-duty catalogue binders with appropriate labeling.

C. Binders shall be indexed by material and/or system type and at a minimum shall include:

1. Title page with clear plastic protection cover.
2. List of Drawings.
3. Description of Systems: Provide complete and detailed description of systems.
4. Operating Division: Provide complete and detailed operation of major components.
5. Maintenance Division: Provide preventative maintenance schedule for major components.
6. List of Equipment Suppliers and Contractors: Provide list of equipment suppliers and contractors, including address and telephone number.
7. Certification: Include copy of tests performed on insulation, grounding, continuity, signal systems, etc.; equipment tag identification and wiring color code; inspection approval certificates for electrical systems and operational tests on applicable communications cabling systems and equipment.
8. Shop Drawings and Maintenance Bulletins: Provide materials received in compliance with clause 'Shop Drawings', arrange alphabetically.

D. Divider Tabs: Laminated Mylar plastic and colored according to Section.

E. Submit documents for approval prior to being turned over to the Owner.

1.20 RECORD DRAWINGS

A. Submit under provisions of Division 01 – General Requirements, and in accordance with the following:

B. Keep on site at all times an extra set of drawings and specifications recording changes and deviations from contract documents including all addendum, bulletin and request for information data. Documents shall be updated on a daily basis. This set of documents shall be used specifically for this purpose.

C. The record drawings shall accurately reflect the as-built conditions at the time of the project completion.

D. Record drawings shall be presented with maintenance manuals to the Architect for approval at the time of final acceptance of the project, prior to being turned over to the Owner.

1.21 CLEANING

A. Refer to Division 01 - General Requirements.

B. Prior to the date set for final inspection and at the direction of the Architect, all new Communications system(s) components, cabinets, devices, and equipment in general, shall be cleaned as required to remove plaster, dust, paint splashes, labels, etc. from the equipment and fixtures.

C. Any damage in system(s) or other damage to any part of the building, its finish or furnishings, due to failure to properly clean electrical equipment and or associated components, shall be repaired by this Contractor at no additional cost to the Owner.

1.22 PAINTING

A. Refer to Division 01 - General Requirements; and Division 09 – Finishes.

B. Prepare for painting of exterior surfaces of unfinished materials, equipment, ironwork, etc. exposed in finished areas by cleaning surface of foreign matter, grease, dirt, and dust.

C. Paint exposed items or equipment, and all structural steel or miscellaneous metal, installed under this portion of the specifications.

D. Refer to Painting section(s) of the specifications under Division 09. Surfaces shall be primed and finish painted. Each coat shall be a different shade, with final coat of the color as selected by the Architect.

E. Paint on factory finished equipment chipped or scrapped during installation shall be touched up. Touch up paint to be supplied by equipment manufacturer.

1.23 SPECIAL EQUIPMENT CONDITIONS

A. Provide a combination telephone/data outlet adjacent to the main ATC/DDC panel; and to other ATC/DDC sub-panel(s), when indicated on the drawings.

B. Engineering drawings are, of necessity, schematics for special equipment as exact roughing-in and requirements may vary with different manufacturers. Each trade shall connect its respective services to all special equipment indicated on the drawings at no additional cost to the Owner.

1.24 ELECTRICAL/MECHANICAL SOUND CONTROL

A. All equipment shall operate without objectionable noise or vibration within Noise Criteria Curves listed in Sound Control Fundamentals of the latest edition of the ASHRAE Handbook of Fundamentals. Sound and vibration measurements shall conform to the ASHRAE Handbook of Fundamentals. If such objectionable noise or vibration shall be produced and transmitted to occupied portions of the building by electrical/mechanical equipment (i.e. generators, transformers, etc.) or other parts of this work, any necessary changes, as approved shall be made without additional cost to the Owner. Noise levels shall conform to the requirements of OSHA.

B. Any and all other insulation or isolation required to accomplish results specified above shall be furnished and installed without additional cost to the Owner.

C. Isolation systems shall be installed in strict accordance with the manufacturer’s written instructions and submittal data. Locations of all vibration isolation products shall be selected for ease of inspection and adjustment, as well as for proper operation.

D. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.

1.25 FINAL ACCEPTANCE

A. Refer to Division 01 - General Requirements.

B. When the installation is reported in writing by the contractor to be complete and ready for acceptance, an inspection shall be made by the Contractor and in the presence of the Engineer to ascertain whether it complies with the contract documents. If in the opinion of the Engineer it fails to do so, the Contractor shall at once remedy all defects and shortcomings.

C. Any additional tests that may be required shall be entirely at the Contractor's expense.

D. All testing work shall be done when and as directed by the Engineer.

1.26 OWNER INSTRUCTION

A. Refer to Division 01 - General Requirements.

B. Furnish the services of qualified personnel, approved by the Engineer and thoroughly familiar with the completed installation, to instruct the Owner’s permanent operating personnel in the proper operation of all systems included under this contract and the proper care of all equipment and apparatus. Unless required otherwise in the technical sections of this specifications, these services shall be furnished for a period of one (1) 8-hour day, after the operation of the systems has been taken over by the Owner.

C. When instructions are provided under this contract, the Contractor shall have in his possession three (3) copies of an identifying letter which shall list the names of the Contractor's qualified instruction personnel, including manufacturers' representatives and subcontractors that will be giving the instructions. Likewise, on this same letter, spaces shall be provided for the Owner's personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor's representatives and subcontractors shall sign and date the letter, and the Owner's personnel shall sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One signed copy shall be delivered to the Owner, one copy to the Engineer and one copy shall be retained by the Contractor.

D. In addition to the instructions outlined above, the Contractor and his manufacturers' representatives and subcontractors shall furnish written basic instructions indicating the proper operation of each system and associated equipment. Each manufacturer shall also submit a brochure on his equipment, including instructions on operation, recommended spare parts, and instructions on preventative, routine and breakdown maintenance.

E. Combine the written instructions and the manufacturers' equipment brochures in complete volumes with hardback binders which shall be turned over to the Owner before final acceptance of the contract work. The Contractor shall obtain two (2) copies of a signed receipt from the Owner for the written instructions and equipment brochures. One copy of the receipt shall be delivered to the Engineer and one copy retained by the Contractor.

2 PRODUCTS

2.1 VIBRATION ISOLATORS

A. Neoprene Isolation Pads:

1. Neoprene isolation pads shall be single rib or crossed, double rib neoprene in shear pads, in combination with steel shims when required, having minimum static deflections as tabulated. All neoprene pads shall be true neoprene in-shear using alternately higher and lower ribs to provide effective vibration isolation, and shall be molded using 2500 psi tensile strength, oil resistant, compounds with no color additives. Pads shall be 45 or 65 durometer and designed to permit 60 to 120 psi loading, respectively, at maximum rated deflections. Neoprene in-shear isolation pads shall be provided to meet tabulated minimum operating static deflections without exceeding published maximum static deflections. Use single or, crossed, double rib or laminated composites of both as required. When two pads of ribbed material are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate.

2.2 PIPE CURBS, EQUIPMENT SUPPORTS, AND FLASHING

A. Prefabricated curbs and supports:

1. Roof Pipe Curbs: Minimum 18 gauge galvanized steel construction with continuously welded corner seams, factory installed wood nailer and 1-1/2”, 3 pound density rigid fiberglass insulation, acrylic coated ABS plastic cover with required number of openings for piping and conduit, and graduated step neoprene boots with stainless steel clamping bands. Style shall be coordinated with roof construction. Minimum height shall be 12” above finished roof surface.

2. Roof Equipment Supports: Minimum 18 gauge galvanized steel construction with continuously welded corner seams, factory installed 2x4 wood nailer and 18 gauge galvanized steel counter-flashing and screws. Style shall be coordinated with roof construction. Minimum height shall be 12” above finished roof surface.

B. Pipe Boots: Minimum .060” thick EPDM, neoprene, or Hypalon, ozone and ultraviolet resistant, minimum service temperature range of -60°F to 270°F, 3’ base flange, conical shaped steps with double thick molded ribs for each pipe size, stainless steel clamps.

C. Sheet copper flashing: Conform to ASTM B 152, weight not less then 8 ounces per square foot.

D. Sheet lead flashing: Weight not less then 3 pounds per square foot for field constructed flashings and not less than 2-1/2 pounds per square foot for prefabricated flashings.

2.3 FIRESTOPPING

A. Refer to appropriate sections of Division 07 for additional information and requirements.

B. Compliance

1. In accordance with IBC requirements and Authority Having Jurisdiction.
2. ASTM: E84-96 and E814-94
3. Factory Mutual Engineering and Research Corporation (FM)
4. Underwriters Laboratories, Inc. (UL): 1479
5. Warnock Hersey (WH)

C. Materials

1. Use either factory built firestop devices or field erected through-penetration firestop systems to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.

2. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 4 in nominal pipe or 16 sq. in. in overall cross sectional area.

3. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.

4. Firestop sealants used for firestopping or smoke sealing shall have following properties:

   a) Contain no flammable or toxic solvents.

   b) Have no dangerous or flammable outgassing during the drying or curing of products.

   c) Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.

   d) When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

5. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:

   a) Classified for use with the particular type of penetrating material used.

   b) Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.

   c) Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.

6. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.

7. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

8. Materials shall be asbestos free.

2.4 IDENTIFICATION LABELS FOR EQUIPMENT

A. Identification labels (Nameplates) for equipment shall be standardized for the project at 1/16” thickness, by 3” in length, by 1” in height, having engraved white letters 1/4" height on a black background.

   1. Exceptions shall be made to increase size (as approved by the engineer) for field requirements or other needs requiring a different length, etc. to satisfy conditions.

B. Labels shall be manufactured of engraved Phenolic Plastic, Micarta or Bakelite with pressure-sensitive adhesive backing, and shall be colorfast. Flexible plastic punched tapes are not be acceptable. Nameplates shall be electrically non-conductive with beveled edges Adhesive backing shall be chemically compounded to hold tight and fast at wide temperature extremes and environments. Equipment or item to receive the adhesive backed label shall be cleaned per label makers recommendations prior to application. Additionally, all labels shall be secured with screws or rivets. Coordinate labels with those being supplied under other contracts.

C. Nameplates shall conform to Military Standard LP 387A Type N.D.P. LP 509

D. Labels shall be as manufactured by Seton NamePlate Company, Bunting Company, Brimar Industries, or approved equal.

2.5 ACCESS PANELS

A. Furnish factory-fabricated access panels for access to all concealed pull boxes, junction boxes, capped conduits and other electrical equipment where no other means of access is available. Access panels for electrical work, along with all required auxiliary or supporting steel, hardware, etc, shall be furnished by the electrical contractor to the general contractor, who shall install them. Access panels are not required at lift-out removable tile ceilings.

B. Access panels shall be of appropriate size but not less than 18" x 12". Panels shall be flush type, hinged to drop down and out, screwdriver operated, stainless steel in masonry and tile work and prime-coated sheet steel in plaster or acoustical tile of all types.

C. At locations where access panels are installed in fire-rated ceilings, access panels shall contain the 1-1/2" hour fire-rated "B" label, and, in addition, shall also be provided with layers of gypsum wallboard in a thickness which will supply an additional one-hour fire rating. Coordinate rated ceiling requirements with the Architectural drawings.

D. Determine the exact locations and sizes of required access panels and coordinate same with the Architect. Access panels shall not be installed without prior approval of the Architect. All panels shall be installed and located to present a neat and symmetrical appearance.

E. Junction boxes, capped conduits and other electrical equipment above removable tile ceilings or above panels shall be suitably identified by small, inconspicuous adhesive-backed labels attached to the ceiling surface or the surface of the access panel. Labels shall be additionally secured with screws or rivets. Labels shall be white with 3/8" high black letter and shall be a manufactured item for that purpose.

3 EXECUTION

3.1 GENERAL INSTALLATION

A. All work shall be installed in a neat and workmanlike manner by craftsmen experienced in the trade involved and shall be acceptable to the Engineer. All details of installation shall be mechanically and electrically correct. All materials and equipment shall be new, and without imperfections or blemishes, unless otherwise noted.

1. Only qualified personnel familiar with proper voltage equipment shall perform work covered by this Division of the Specifications.

B. Before ordering any material or doing any work, the Contractor shall verify all measurements at the site and shall be responsible for the correctness of same. No compensation will be allowed on account of difference between actual dimensions and measurements and those indicated on the drawings. Any difference, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

C. This specification includes under each item all labor, material and equipment necessary to properly install complete, adjust, and place in operating condition, satisfactory to the Engineer, the several branches of work described herein. This shall include all necessary interconnections between the several branches of work described herein, and connections to work under other sections of specifications and other contractors.

D. All items of labor, material or equipment not described in detail by specifications or drawings, but which are incidental to or necessary for complete installation and proper operation of several branches of work described herein, or reasonably implied in connection therewith, shall be furnished and/or installed as if called for in detail by drawings or specifications.

E. Follow all safety requirements as required by Code, including but not limited to those listed below:

1. Printed instructions shipped with the equipment.
2. Code-required and/or industry-accepted practices.
3. Electrical safety guidelines and practices.

F. The drawings are generally indicative of the work required and shall be followed as closely as circumstances will permit, however they do not indicate all bends, fittings, boxes and accessories which may be required. The Contractor shall carefully investigate structural and finish conditions affecting work and arrange work accordingly, furnishing such fittings, accessories, etc., required to meet such conditions. Contractor will be held responsible for proper installation of materials and equipment to the true intent and meaning of contract documents.

G. Carefully examine all contract documents, including those of all other trades; layout, plan and execute electrical work so as not to delay or interfere with the work of other trades. Obtain in writing from contractors of other trades such data as is necessary for proper coordination of the work.

H. Lay out work from dimensions of architectural and structural drawings and actual dimensions taken at the site; and from the approved dimensions of equipment being installed. Layouts in general shall <u>not</u> be scaled from electrical and/or mechanical drawings, but in congested areas in particular. No extra compensation will be allowed on account of difference between actual dimensions and measurements and those indicated on the drawings. Any difference, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

I. Coordinate locations of conduit, wiring, outlets, devices, equipment, etc. to be clear of windows, doors, openings, diffusers, return grilles, sprinklers and other services and utilities. This Contractor shall be held responsible to coordinate his work with that of all other trades so that all work may proceed in an orderly manner and conflicts and delays may be avoided. Where drawings indicate special space allocation for different contracts, contractors shall rigidly adhere to the sequence of installation designated by the Engineer or required to allow all trades to work their equipment or materials into place and in respective order. Special attention shall be paid to work under the floor slabs, above ceilings and in locations otherwise concealed. All work shall be thoroughly tested before being closed in.

J. Secure dimensions of all telephone, data and similar device outlets; and other Communications equipment in general, immediately upon the award of the Contract. Work closely with the General, HVAC, Plumbing, Electrical and/or other Contractors and provide to them the necessary information and dimensions so that there will be no interference between piping, duct work, structural steel, furring channels, etc. and Communications systems, equipment and wiring.

K. Where outlets in ceiling construction occur in beams instead of in center, move outlets to center. Architect's final approval, however, is required prior to any such relocation. In case interference or fouling results, the Architect shall decide which is to be relocated, regardless of which is first installed.

L. Where required and as necessary, firmly support and secure all materials and equipment installed under this Contract to the building construction.

M. Determine the location and size of chase(s) and opening(s) necessary for proper installation of electrical work, sufficiently in advance and have same provided during erection of the work in which the chases and openings are required. This contractor shall furnish and set sleeves, hangers, and anchors, and shall be responsible for their proper and permanent location.

N. In cases where cutting of new building construction is necessary due to failure of this contractor to set proper sleeves or inserts, or to properly coordinate openings and chases required in said construction, such cutting shall be done and repaired to match the original condition of the work by this contractor and for no additional compensation.

O. Points of connection and termination of work under this specification are shown or noted on the drawings and/or stated within the specification; in case of doubt as to such points, the Engineer's decision shall be final.

P. Equipment, conduit, wiring, devices and other Communications work shall be installed so as to preserve access to items that are intended to be accessible (i.e. cabinet doors, valves, filters, accessories, etc.), both those furnished under this specification and those furnished under other specifications. Clearances shall be provided on all sides of equipment as required for proper maintenance purposes, recommended by the equipment manufacturer, required by the National Electrical Code or required by other applicable codes.

Q. Follow manufacturer's published recommendations for installation methods not otherwise specified.

R. Furnish the services of manufacturer's representatives for each piece of major equipment furnished under these contract documents. The amount of factory service provided by the contractor shall be as normally recommended and furnished by the various equipment manufacturers unless specified otherwise.

S. Testing of equipment shall be made under the direct supervision of competent authorized service representatives. Any and all expenses incurred by equipment manufacturers' representatives shall be borne by the contractor.

T. Seal all openings left in building construction by the installation of work specified under this section. Sealing shall be performed in accordance with "Cutting and Patching" section specified herein and as directed by the Architect.

U. Where the vapor barrier of any insulation is broken due to the installation of conduit and equipment, properly repair all insulation and seal all openings with vapor barrier covering and vapor barrier adhesive of type installed with the insulation.

V. Upon completion of the work, all remaining waste materials and rubbish resulting from the contract work shall be removed from the building and premises.

W. Should job conditions or specified requirements conflict with manufacturer's instructions, consult the Engineer for clarification. Do not proceed with work without clear instructions.

X. The Contractor and his subcontractors shall satisfactorily complete the systems so that they are functional and operating to the satisfaction of the Engineer. All systems, their controls and their sequencing must be demonstrated to the satisfaction of the Engineer.

Y. Field Adjustments: Make minor modifications to equipment and/or wiring required for proper operation and conformance with project intent; notify owner in writing of any major equipment modifications which may be required prior to proceeding.

3.2 TELECOMMUNICATION SERVICES

A. Verify all service information herein or shown on the drawings, and communicate with the Local Area Telecommunications Utility Company(s) to obtain and coordinate exact conditions and information relative to the installation of new telecommunications (telephone, CATV, etc.) services. This contractor shall be responsible for the coordination and installation of required telecommunication service(s) as indicated by the drawings and directed by the Owner, complete in every detail and incorporating all labor, items and costs required by written instructions or information received from the Telecommunications Utility Company(s) except as otherwise indicated.

B. Site/building access conduit(s) or duct bank(s) shall be furnished and installed by the Division 26 – Electrical contractor unless noted or directed otherwise.

C. Coordinate all work with the Owner, Telecommunications Utility Company(s) and Electrical contractor as hereinbefore specified.

3.3 RELOCATION OF EXISTING WORK

A. Where existing equipment, wiring, cables, outlets, etc. are indicated as being relocated and a connection is not shown or noted, this Contractor shall provide a new homerun back to the telecommunications closet, MDF or IDF which serves that area of the building.

B. Same shall apply where general construction work interrupts the continuity of Communications cabling to any outlet or equipment or requires relocation of existing Communications equipment and/or wiring or cabling – whether such work is specifically indicated on the drawings or not.

3.4 EQUIPMENT CONNECTIONS

A. The drawings show generally the location of each piece of equipment. However, this contractor shall secure detailed shop drawings showing dimensioned locations for

Communications service to each piece of equipment from various contractors supplying such equipment prior to roughing-in.

B. This contractor will be required to relocate any misplaced outlet at his own expense if he fails to secure detailed shop drawings prior to roughing-in for equipment.

3.5 AUTOMATIC TEMPERATURE CONTROL (ATC) WIRING

A. Furnish a combination telephone/data outlet adjacent to the main ATC Panel and/or where shown on the drawings.

3.6 PIPE CURBS; EQUIPMENT SUPPORTS; AND FLASHING

A. Coordinate installation of curbs, equipment supports, and flashing with the roofing work. Refer to Architectural drawings for related details.

B. Minimum curb and support height shall be 12 inches.

C. Flash and counter flash where electrical conduit and equipment passes through weather or waterproofed walls, floors and roofs.

3.7 FIRESTOPPING

A. Install sleeves and firestopping at all openings in fire and smoke rated barriers around wiring and equipment installed under this contract to maintain the rating of the barrier.

B. Firestopping materials shall maintain the fire rating of the barrier in accordance with the requirements of NFPA, the local governing bodies and other applicable codes.

C. Refer to the Architectural drawings for locations and ratings of all fire and smoke rated barriers.

3.8 IDENTIFICATION OF EQUIPMENT

A. Coordinate identification systems with Owner’s existing systems or master systems before ordering material.

B. Clean all surfaces in accordance with manufacturer's recommendations before installing identification. Identification shall not be installed before final painting is complete.

C. Nameplates:

1. Install interior nameplates with permanent adhesive, screws, bolts or rivets.
2. Install exterior nameplates with screws, bolts or rivets.
3. Identify components such as switchboards, panelboards, safety switches, junction boxes, breakers, terminal cabinets, etc.
4. Equipment shall be identified by title as taken from the plans in a position that is clearly visible. Nameplate nomenclature shall be verified with building owner and Engineer prior to installation.

5. Identify the location of equipment concealed above a ceiling with a color-coded thumbtack in ceiling.

3.9 MOUNTING HEIGHTS

A. In addition to careful review of the electrical drawings, this Contractor shall refer to all applicable details, plans, etc. of the architectural drawings for exact positioning of electrical, telephone, data, television, video, etc. outlets prior to installations. Unless otherwise specifically instructed, centerline-mounting heights of outlets and other equipment shall be located as follows:

1. Telephone Outlets: 18" above finished floor except as otherwise noted. Outlets for wall phones shall be located 44” above finished floor.
2. Data Outlets: 18" above finished floor except as otherwise noted.
3. Television Outlets: 18" above finished floor except as otherwise noted. Coordinate locations for wall mounted televisions with Architectural details.
4. Outlets Above Countertops: 8" above top of counter without backsplash, or 6" above top edge of backsplash, except as otherwise noted.
5. Blank Outlets: Coordinate location with served equipment manufacturers shop drawing and installation details for service connection point of access except as otherwise noted.
6. Nurse Call System Stations: 44” above finished floor except as otherwise noted.
7. Nurse Call Dome Lights: 12" below finished ceiling, as otherwise indicated on drawings or as directed.
8. Code Blue Stations: 44" above finished floor except as otherwise noted.

B. Where exact location, mounting height or orientation for a device, fixture, outlet or other electrical equipment may be unclear, request clarification from the Architect prior to rough in or installation.

END OF SECTION

SECTION 270526 – GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. General grounding and bonding requirements of Communications systems installations for personnel safety and to provide a low impedance common ground reference plane.

1.2 QUALITY ASSURANCE

A. Grounding and bonding equipment, including all necessary accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Institute of Electrical and Electronics Engineers (IEEE)
4. Underwriters Laboratory (UL) listed and labeled.
5. American National Standards Institute/Telecommunications Industry Association/Electronics Industries Alliance (ANSI/TIA/EIA)-607, Grounding and Bonding

1.3 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of Section 270500 and General Conditions of Contract.

2 PRODUCTS

2.1 GENERAL DESCRIPTION

A. All grounding and bonding connections shall be solderless except where indicated otherwise on the drawings or hereinafter. Grounding shall be performed in strict accordance with the NEC, particularly Article 250 as applicable.

B. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.

C. It is essential and extremely important that the contractor familiarize himself thoroughly with all applicable codes prior to the installation of grounding system. All ground conductors, methods of installation, etc., shall be in accordance with Code requirements.

2.2 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for

all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per the NEC.

B. All connection of ground conductors to ground rods, bus bars, rebar, structural members, pipes or fences, and splices of ground conductors, shall be made by exothermic welds except where otherwise noted. All connections to bar lugs shall be exothermic weld or compression type. Bolted type connection of ground conductors may only be made where terminal lugs or blocks have been furnished and installed in equipment by the manufacturer. The basis of design for exothermic welds shall be the "Cadweld" process manufactured by Erico.

C. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be solid bare copper wire.

D. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

2.3 GROUND RODS

A. Ground rods shall be copper-bonded steel. The copper-bonded ground rods shall have an electrolytic coating of copper deposited over a layer of nickel. This process shall ensure a long lasting, molecular bond between the copper layer and the steel core. Copper sheathed, steel core ground rods will not be acceptable.

B. Ground rods shall be of sufficient lengths to penetrate at least 6" in permanent moist earth but not less than 8'-0" in length with a minimum diameter of 5/8” and 10 mils of copper.

C. Quantity of rods shall be not less than as indicated on the drawings or as required to obtain the specified ground resistance hereinafter.

2.4 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL standards and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 270500 and manufacturer’s recommendations.

3.2 GENERAL

A. Ground Communications systems and equipment in accordance with requirements of the National Electrical Code and as indicated on the drawings.

B. Equipment Grounding: Metallic structures enclosures, raceways, junction boxes, outlet boxes, cabinets, equipment frames, and other conductive items utilized in conjunction with the Communications system(s) shall be bonded and grounded.

3.3 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

B. Arrange for observation of all such connections by the local Electrical Inspector prior to connections being covered or becoming otherwise inaccessible.

3.4 GROUNDING CONNECTIONS SUBJECT TO MECHANICAL INJURY

A. Where grounding conductors are subject to mechanical injury, they shall be protected by encasement in concrete or installed in a rigid metallic raceway.

3.5 SECONDARY EQUIPMENT AND CIRCUITS

A. Conduit Systems:

1. Ground all metallic conduit systems in accordance with NEC requirements.

2. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

B. Boxes, Cabinets, and Enclosures:

1. Bond each pullbox, junction box, outlet box, device box, cabinets, and other enclosures utilized in conjunction with Communications systems.

2. Provide lugs in each box and enclosure for grounding conductor termination.

3.6 TELECOMMUNICATIONS SYSTEM

A. Perform installation of telecom system grounding and bonding infrastructure in accordance with applicable codes, ANSI/TIA/EIA-607, latest edition of NEC and the requirements contained herewithin.

B. Install electrotin plated copper telecom grounding busbar on 2” high, insulated standoffs in telecom service entrance room, telecom equipment room and each telecom closet. Busbars shall be predrilled with rows of holes in accordance with NEMA standards and the type of connectors to be used. Minimum busbar size shall be ¼” thick x 4” high x variable length (sized in accordance with immediate termination requirements and for 50% future growth). Minimum height of busbars for telecom closets shall be 2” high.

C. Telecom bonding conductors shall be insulated no. 4 AWG copper with listed two hole compression or exothermic welded connectors (unless otherwise noted). Insulation shall be green with blue tracer.

D. Bond telecom grounding busbar located in telecom service entrance room to electric service entrance equipment ground bus.

E. Bond together telecom grounding busbars located throughout entire building.

F. Bond telecom equipment, frames, voltage protectors, isolation gaps, telecom backbone cable shields, building structural steel, metallic raceways for telecom cables, etc., in the telecom service entrance room, telecom equipment room and each telecom closet to the room telecom grounding busbar (TGB). Where a panelboard serving telecom equipment is located in the same room as a TGB, that panelboard's enclosure shall be bonded to the TGB.

3.7 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth.

B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with compression type ground connectors.

C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

END OF SECTION

SECTION 270529 – HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. This Section includes secure support from the building structure for Communications systems items of work by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.2 QUALITY ASSURANCE

A. Supporting devices, including all necessary components and associated accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Underwriters Laboratory (UL) listed and labeled.

B. Comply with the current governing building codes regarding restraints due to earthquake loads.

2 PRODUCTS

2.1 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.2 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:

1. Expansion Anchors: Carbon steel wedge or sleeve type.
2. Toggle Bolts: All steel springhead type.
3. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. U-Channel Systems: Min. 16-gage steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

2.3 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:

a) Up to 6-inch: 16-gage.

b) Over 6-inch: 14-gage.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

3 EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten Communications systems components securely and permanently from the primary building structure in accordance with National Electrical Code requirements.

B. Coordinate with the building structural system and with other work installations.

C. Raceway and Cable Supports: Comply with National Electrical Code and the following requirements:

1. Support all cables at intervals not exceeding 6 feet.

2. Use of wire ties for raceway and component attachment, or for permanent attachment of cabling, is <u>not</u> permitted.

3. Conform to manufacturer's recommendations for selection and installation of supports.

4. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four.

a) Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.

5. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

6. Support parallel runs of horizontal raceways together on trapeze-type hangers.

7. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

8. Space supports for raceways in accordance with the NEC.

9. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

10. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

D. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

E. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

F. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant or system in gaps between sleeves and enclosed conduits and cables in accordance with “Firestopping” requirements of Section 270500.

G. Conduit Seals: Install seals for conduit penetrations of exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

H. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

END OF SECTION

SECTION 270533 – RACEWAY AND CONDUIT FOR COMMUNICATIONS SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Raceways for Communications systems cabling and wiring; complete, including all necessary elbows, couplings, fittings and associated accessories. Types of raceways in this section include the following:

   a) Rigid Metal Conduit

   b) Electrical Metallic Tubing

   c) Flexible Metal Conduit

   d) Liquidtight Flexible Metal Conduit

   e) Rigid Nonmetallic Conduit

   f) Conduit Bodies

   g) Wireway

1.2 QUALITY ASSURANCE

A. The raceways, including all necessary elbows, couplings, fittings and associated accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Underwriters Laboratory (UL) listed and labeled.

1.3 RECORD DOCUMENTS

A. Document the following on final set(s) of As-Built drawings:

1. Routing of raceways and conduits utilized for riser and “backbone” cabling distribution (including notation of conduit rises, conduit drops and locations of junction boxes).

1.4 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of Section 270500 and General Conditions of Contract for the following equipment:

1. All Conduit Types (utilized on the project)
2. Conduit Bodies
3. Wireway

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Conduit:
   a) Allied Tube & Conduit
   b) Wheatland Tube Company
   c) Eastern Wire & Conduit
   d) Western Tube & Conduit
   e) Cantex
2. Conduit Bodies:
   a) Thomas & Betts
   b) Oz-Gedney
   c) Crouse-Hinds
3. Wireway:
   a) Hoffman
   b) Square D
   c) Hubbell-Wiegmann

2.2 RIGID METAL CONDUIT

A. Rigid metal conduit (RGS) shall be made of zinc-coated steel piping complying with ANSI C80.1 and UL 6. It shall be of sufficient weight and toughness to withstand cracking and peeling during bending. Galvanizing shall consist of a coating of zinc of uniform thickness applied to inside and outside of walls by either electrolytic or hot metal dip process.

B. Each piece of conduit shall be straight, free from blisters and other defects, cut square and taper reamed and shall be furnished in 10 foot lengths, threaded at each end. Couplings shall be supplied at one end and protection for the other end. All threads shall be cleanly cut. Each length shall bear the Underwriters' Label.

C. Fittings:

1. Comply with NEMA FB 2.10-2007, Selection and Installation Guidelines for Fittings for Use With Non-Flexible Metallic Conduit or Tubing.
2. Zinc-coated steel, if size 2-1/2 inches or less, and zinc-coated malleable iron if larger. Dependent upon application, fittings shall be rated rain tight or concrete tight when applicable.

2.3 ELECTRICAL METALLIC TUBING

A. Electrical Metallic Tubing shall be the same general construction as rigid metal conduit specified above, except for wall thickness and fittings, which shall be zinc-coated steel compression type for all sizes. Set screw type fittings will not be acceptable.

B. Electrical Metallic Tubing shall be constructed in compliance with ANSI C80.3 and UL 797.

2.4 FLEXIBLE METAL CONDUIT

A. Flexible Metal Conduit shall be made of helically wound, formed, interlocked zinc-coated steel strip complying with UL 1. It shall be of sufficient weight and toughness to withstand damage during bending.

B. Cut ends shall be trimmed or otherwise finished to remove rough edges.

C. Fittings shall be constructed of zinc-coated steel, if size 3/4 inch, and zinc-coated malleable iron if larger. Fittings shall be squeeze/clamp type with deep slotted machine screw for securing conduit.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Liquidtight Flexible Metal Conduit shall consist of an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible zinc-coated steel core complying with UL 360. It shall be of sufficient weight and toughness to withstand damage during bending.

B. Fittings shall be constructed of zinc-coated steel, if size 1 inch or less, and zinc-coated malleable iron if larger. Fittings shall be compression type with steel ferrule and neoprene gasket sealing rings.

2.6 RIGID NONMETALLIC CONDUIT

A. Rigid Nonmetallic Conduit shall be constructed of Schedule 40 polyvinyl chloride (PVC), sunlight resistant, rated for use with 90 degree Celsius conductors and in compliance with UL 651.

B. Fittings and cement designed especially for this type of conduit shall be used throughout. Conduit shall be firmly anchored in trenches. Wherever possible, offset fittings shall be avoided and conduit shall be swept to radius and bent as required.

2.7 CONDUIT BODIES

A. General: Provide types, shapes and sizes as required for the application. Conduit Bodies shall have threaded hubs and removable gasketed covers secured with zinc-coated steel screws.

B. Metallic Conduit and Tubing: Conduit Bodies shall be constructed of zinc-coated iron.

C. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies suitable for the application and approved for use with the raceway.

2.8 WIREWAY

A. General: Furnish and install wireway of proper types, sizes and number of channels as shown on the drawings or required per the application and field conditions. Wireways and associated fittings shall be constructed in accordance with UL 870.

B. Covers shall be hinged, removable and capable of being reinstalled without tools. Provisions shall be included in the construction to allow screwing the hinged cover closed without the use of parts other than the standard lengths, fittings and connectors. It shall also be possible to seal the cover in a closed position with a sealing wire. Wireway shall be constructed with knockouts.

C. All sheet metal parts shall be provided with a rust inhibiting phosphatizing coating and gray baked enamel finish. All hardware shall be plated to prevent corrosion. All screws installed toward the inside shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage.

D. All connectors shall be slip-in type with self-retained mounting screws. All hangers shall be two-piece with hook together feature to permit preassembly of wireway and hanger bottom plate before hanging on preinstalled upper bracket.

E. Wireway shall be so installed that the hinged cover surface is in the vertical position to allow for easy accessibility to conductors and preclude the spilling of conductors when cover is opened.

F. All lengths, connectors and fittings shall be UL labeled and installed in accordance with the National Electrical Code and as shown on the drawings. UL listing of lengths without listing of connectors or fittings is not acceptable.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 270500 and manufacturer’s recommendations.

B. The entire conduit installation shall be concealed in the construction except that it may be run exposed in unfinished areas and mechanical rooms. Where un-plastered concrete slab ceilings occur, conduit shall be installed in ceiling slab. No exposed conduits will be permitted on finished walls or ceilings, unless otherwise noted.

C. Unless noted on the drawings or required for installation (i.e. floor boxes), conduit is NOT permitted to be installed underground within the building footprint for feeders or branch circuits without prior approval from the engineer/owner.

D. Rigid metal conduit shall be furnished and installed below concrete slabs on grade, within walls or in "web" (void) of metal decking above grade.

E. Rigid metal conduit is permitted to be installed within concrete slabs, provided that both:

1. Minimum concrete slab thickness is 4 inches

2. Concrete slab provides not less than 2 inches cover over conduit.

F. Electrical metallic tubing may be utilized at all other locations as allowed by the National Electrical Code, except where subject to damage or otherwise specified.

G. Do not install conduit in stone/cinder fill. However, where this is impracticable, utilize GRS conduit encased on all sides by not less than 2 inches of concrete.

H. Utilize fittings marked “Concrete-tight” or “Raintight” where conduit is intended for embedment in poured concrete. Utilize fittings marked “Raintight” or “Wet locations” where conduit is intended for installation underground, outdoors, or in wet locations. Threaded fittings shall be made up wrench tight.

I. Conduits shall be run as straight and direct as possible to limit number of bends or offsets to a minimum. Exposed conduits shall be installed with runs parallel or perpendicular to walls and ceilings, and with right angle turns utilizing conduit bodies or symmetrical bends. Exposed vertical conduit runs shall be run on the building walls or columns, where possible. Where switch and receptacle outlets occur in exposed runs, zinc-coated cast iron device boxes shall be used at these locations. Review all portions of exposed raceways in finished areas with the Architect prior to installation.

J. Not more than the equivalent of four (4) 90-degree bends will be allowed in any one run of conduit. Where more bends are necessary, a pull box shall be installed. All couplings shall be pulled up tight so as to provide an electrical bond throughout the entire conduit system.

K. No conduit smaller than 3/4 inch trade size shall be used in any part of the various systems, nor shall the conduit be smaller than the size recommended by the manufacturer for the Communications system equipment, Local Telephone Company, etc. Secure this information from the manufacturer of the equipment, Local Telephone Company, etc. prior to rough-in. Crowding wiring will not be permitted.

L. Conduit bends shall be of the large radius, machine-made, without kinks, flattening or crushing. Conduit may be bent by using an approved pipe bending machine or hickey.

M. Conduits installed directly under roof decking shall be installed a minimum distance of 1 1/2” below the roof deck.

N. Conduit ends shall be square cut and reamed to remove burrs. Cut EMT utilizing a hack saw or band saw; do not use roll-type tubing cutters. Conduit shall be installed in such a manner that wires may be removed and replaced at a later date.

O. Approved threaded couplings, such as the 3-piece coupling (Erickson) or suitable union, shall be used where construction requires the use of a union. Running threads will not be permitted. Expansion fittings shall be used where conduit crosses expansion joints.

P. Where steel conduit is threaded in the field, the thread shall be coated with an approved electrically-conductive, corrosion-resistant compound. Coatings for this purpose, listed under UL category “FOIZ” are available; zinc-rich paint or other coatings acceptable to the AHJ may also be used.

Q. Raceway supports shall be installed and supported in accordance with requirements of the National Electrical Code and specification section 270529. Raceways are permitted to be mounted directly to the building structure. Assure that supporting means and associated fasteners are compatible with the mounting surface from which they are supported. Raceways supports shall be installed only on conduit of the trade size indicated on the fitting (or smallest respective shipping container).

R. Each end of every conduit run terminating in a pressed steel box of any type shall be provided with a galvanized locknut and bushing inside and a locknut outside. All feeder conduits shall be provided with hardwood or fiber bushings at all junction boxes, panels, etc.

S. Do not rely upon locknuts to penetrate nonconductive coatings or finishes on enclosures. Such coatings shall be removed *in the locknut contact area only* prior to raceway assembly, to ensure continuity of ground path. Touch up bare areas as needed after fitting assembly.

T. Outlet, junction and pull boxes shall be securely anchored to structural members as required or indicated on the drawings and not dependent on conduit for support. If structural members are not provided at locations of boxes for support, this contractor shall furnish and install same.

U. A separation of 6 inches shall be maintained between all conduit and hot water, steam lines and flues in the building. Where conduits, hot water and steam lines are closer than 6 inches an approved pipe covering shall be used over the conduit for the length of the run of such exposure.

V. Provide temporary closure protection for conduits during construction to prevent foreign matter from entering raceways. Provide conduit caps for empty conduits that are installed as spares to prevent foreign matter from entering raceways.

W. Raceway systems shall be installed complete, including tightening of joints, from termination point to termination point prior to the installation of conductors.

X. Install nylon pull line in empty raceways.

3.2 FIELD ADJUSTMENTS

A. Perform field adjustments to the raceway systems as required. The adjustments shall include, but not be limited to: inspecting the interiors of raceways; clearing blockages and removing burrs, dirt, and construction debris.

END OF SECTION

SECTION 270534 – BOXES FOR COMMUNICATIONS SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. This section includes boxes, cabinets and fittings for Communication systems installations and certain types of fittings not covered in other sections. Equipment specified in this section includes but is not limited to the following:

   a) Outlet and device boxes

   b) Pull and junction boxes

   a) Fire-rated poke-through assemblies

   b) Cabinets

   c) Composite Service Boxes (handholes)

1.2 QUALITY ASSURANCE

A. The boxes, cabinets, fittings, etc. included in this specification section shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA) 250
3. Underwriters Laboratory (UL) listed and labeled.

1.3 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of section 270500 and General Conditions of Contract.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Outlet, device, pull and junction boxes:

   a) Thomas & Betts

   b) E-Box

   c) Raco (Hubbell Electrical Products)

   d) O-Z/Gedney

2. Fire-rated poke-through assemblies:

   a) Hubbell

b) Wiremold

3. Cabinets:

a) Hoffman

b) E-Box

c) Picoma Industries

4. Composite Service Boxes (handholes):

a) Quazite

b) Synertech

c) Pencell Plastics Inc.

2.2 BOXES AND FITTINGS

A. General: Furnish and install proper types, sizes and NEMA classes as shown on the drawings or required per the application and field conditions. Provide complete with covers and accessories required for the intended use. Provide gasketed covers for boxes, cabinets and fittings located in damp or wet environments, or otherwise noted.

B. Materials and Finishes:

1. Sheet Steel: Flat-rolled, code-gage, galvanized steel.

2. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

3. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

4. Finish: The interior and exterior of items exposed in finished locations shall be baked enamel. Verify color selections with Architect.

5. Fittings for Boxes, Cabinets and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

C. Metal Outlet, Device and Small Wiring Boxes:

1. General: Conform to UL 514A & UL514B.

2. Steel Boxes: Conform to NEMA OS 1. Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.

a) Outlet and device boxes shall be standard (2-1/4” deep) electrical boxes; shallow (1-1/2” deep) outlet boxes shall not be utilized, except where specifically noted or directed.

3. Cast Metal Boxes: Cast metal, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs. Provide with gasketed cover.

4. Fire-rated poke-through assemblies: Provide flush style fire-rated poke-through (FRPT) assemblies that are UL classified with a fire rating corresponding to that of

the floor construction in which they are to be installed. The construction shall consist of an all-brass service fitting with commensurate floor finish flange and brass duplex flip-open flap type cover with locking screws. They shall be adjustable to accommodate floor thickness. Provide data, voice, video and power receptacles of type and quantity to suite application and system requirements of the specifications and drawings.

D. Pull and Junction Boxes:

1. General: Comply with UL 50 for boxes over 100 cubic inches volume. Boxes shall have screw or bolt on covers of the same material as the box.

2. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.

3. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.

4. Cast Metal Boxes: Cast metal, waterproof, with threaded raceway entries and features and accessories suitable for each location. Provide with gasketed cover.

E. Cabinets

1. General: Comply with UL 50.

2. Construction: Sheet steel of size and NEMA class as shown on the drawings or required per the application and field conditions. Cabinet shall consist of a box and a front consisting of a one-piece frame and a hinged door with flush or concealed door hinges. Provide double door for cabinets wider than 24 inches. Signal system cabinets wider than 48 inches may have sliding or removable doors.

3. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power and lighting system cabinets located within mechanical and electrical rooms. Doors with locks shall be capable of closing without locking.

2.3 COMPOSITE SERVICE BOXES (HANDHOLES)

A. Provide service boxes constructed of polymer concrete reinforced with heavy-weave fiberglass. Minimum compressive strength of material shall be 11,000 psi. Provide heavy-duty covers (minimum 15,000 lb. Over 10 inch square area) with the service identification cast into cover, i.e. TELEPHONE. Provide base section and stackable extensions as required for the installation. Include stainless steel bolts to secure cover.

3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install in accordance with requirements of Section 270500 and manufacturer’s recommendations.

2. Supports for boxes shall be installed in accordance with requirements of specification section 270529 and the National Electrical Code.

3. Locations: Install items where indicated and where required to suit code requirements and installation conditions.

4. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

5. Sizes shall be adequate to comply with NEC volume requirements, but in no case smaller than sizes indicated.

6. Remove sharp edges where they may come in contact with wiring or personnel.

7. Secure boxes firmly in place and set true, square with building lines.

B. Applications:

1. Cabinets: Flush mounted, NEMA enclosure type 1 except as otherwise indicated.

2. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:

a) Interior Dry Locations: Sheet steel, NEMA type 1.

b) Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R.

c) Wet Locations: NEMA type 4 enclosures.

d) Hazardous (Classified) Locations: NEMA type listed and labeled for the location and class of hazard indicated.

3. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

4. At locations where special boxes are required for systems, boxes shall be of the type and size as recommended by the respective system manufacturer.

C. Installation of Outlet Boxes:

1. Outlets at Windows and Doors: Locate close to window trim. For outlets indicated above doors, use mounting height as noted and center outlets above the door opening except as otherwise indicated.

2. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions.

3. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets, or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes flush with the face of the tile or other finish, without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.

4. Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:

   a) Exterior locations.

   b) Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).

   c) Where exposed to moisture laden atmosphere.

   d) At food preparation equipment within four feet of steam connections.

   e) Where indicated.

5. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

6. Mounting: Mount outlet boxes for switches and receptacles with the long axis vertical or as indicated. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.

7. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.

8. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

9. Concrete Boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6-inch depth.

D. Installation of Pull and Junction Boxes:

1. Size: Pull and junction boxes for feeder and branch circuits shall be of adequate size to comply with NEC volume requirements, but in no case smaller than sizes indicated.

2. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30-inches inside boxes.

3. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.

4. Signal Systems: Provide pull and junction boxes for telephone, data and other signal systems at least 50 percent larger than would be required by NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

E. Installation of Cabinets:

1. Mount with fronts straight and plumb.

2. Install with tops 78-inches above floor.

3. Set cabinets in finished spaces flush with walls.

F. Installation of Composite Service Boxes (Handholes):

1. Set service boxes on compacted subbase material.
2. Backfill around service boxes with subbase material.
3. Install top of service boxes flush with adjacent grade.

G. Grounding:

1. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

3.2 FIELD ADJUSTMENTS

A. Inspect components and perform field adjustments as required. Adjustments shall include, but not be limited to: removing burrs, dirt and construction debris; and repairing damaged finish including chips, scratches, abrasions, and weld marks as follows:

1. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the manufacturer.
2. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating. Paint exterior junction box covers as directed by the Architect.

END OF SECTION

SECTION 271000 - STRUCTURED TELECOMMUNICATIONS CABLING SYSTEM

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Voice and data distribution systems; complete, ready for operation, including all cables, raceways, boxes, racks, terminal blocks, patch panels, patch cords, telecommunication outlets, jacks, terminations, testing, and all other accessories and miscellaneous items required for a complete operating system even though each item may not be specifically mentioned or described.
   a) Telephone system electronics, handsets, etc. shall be furnished and installed by the Owner and are Not In Contract.
   b) Data system network electronics shall be furnished and installed by the Owner and are Not In Contract.
2. Performance of all labor and providing and installing all materials, components and accessories as required for the construction of the project as indicated by contract documents.
3. Equipment specified in this section includes but is not limited to the following:
   a) Copper Telephone and Data Cables & Jacks
   b) Fiber Optic Cables and Terminations
   c) Equipment Racks and Cabinets, Rack Accessories, and Patch Panels

B. Contractor shall coordinate with Telephone Company for the owner preferred phone service.

1.2 SCOPE

A. All telecommunication (telephone and/or data) outlets indicated on the drawings shall be wired (interconnected) to the respective telecommunication distribution system(s). Additional voice and/or data lines/outlets shall be provided to support Building Management, Fire Alarm and/or Security Systems as indicated on the drawings or as addressed in other sections of these specifications.

B. The entire facility shall be provided with a complete network of terminal boards, racks, cabinets, terminal blocks, patch panels, cabling, jacks, etc. required to provide fully functional, turn-key telecommunication distribution system(s).

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the manufacturer for both installation and maintenance of the system required for this project.

1. Installer shall have a minimum of one (1) Building Industry Consulting Service International (BICSI) certified Registered Communications Distribution Designer (RCDD) on staff providing general supervision of installation and testing for the duration of the project.
2. Contractor, and service organization, if applicable, shall be located not more than 100 miles from the project site

B. The telecommunication systems, including all necessary parts, accessories, connections and equipment, shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards, including all currently approved addenda issued to date:

1. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises
2. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard
3. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling And Components Standard
4. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard
5. TIA-526-7 “Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant”
6. TIA-526-14-A “Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant”
7. TIA-569-B “Commercial Building Standard for Telecommunications Pathways and Spaces”
8. TIA-570-B “Residential Telecommunications Infrastructure Standard”
9. TIA-598-C “Optical Fiber Cable Color Coding”
10. TIA/EIA-606-A “Administration Standard for Commercial Telecommunications Infrastructure”
11. TIA/EIA-854 “Full Duplex Ethernet Specification for 1000Mbis/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling”
12. J-STD-607-B “Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications”
13. TIA-758-A “Customer-owned Outside Plant Telecommunications Infrastructure Standard”
14. Building Industry Consulting Service International (BICSI).
15. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC).
16. National Electrical Manufacturers Association (NEMA).
17. Underwriters Laboratory (UL) listed and labeled.
18. Institute of Electrical and Electronics Engineers (IEEE).
19. Federal Communications Commission (FCC).

C. All products provided shall be newly manufactured. All equipment proposed as part of the system shall be in current manufacture, off the shelf and not one of a kind, and supported by the Contractor and Manufacturer.

1.4 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 270000 and General Conditions of Contract:

1. Provide complete submittals, which shall include: floor plan drawings indicating device locations and label/identification nomenclature; schematic wiring drawings; elevation views of equipment racks, cabinets, and components; and spec sheets for all equipment.

a) Partial submittals will not be accepted.

b) Spec sheets shall include data on features, ratings, and performance. Components must show compliance with the performance criteria specified herein.

2. Provide copy of Contractor's factory certification and manufacturer's 20-year performance warranty.

3. Provide copy of RCDD certificates of the supervisory personnel associated with this project.

4. Upon request, show record of at least ten (10) previous projects of this type with required warranties.

B. If re-submittals are required, they shall be provided within two (2) weeks after the date of notification. If re-submittals are not received by the Engineer in two (2) weeks, the supplier will be considered nonresponsive and subsequent submittals from the supplier will not be reviewed. The Contractor shall then provide submittals from another equipment supplier within two (2) weeks as directed by the owner, at no change in contract price.

C. The cost of review of any submittals after two (2) submittals have been rejected shall be paid by the Contractor to the Engineer. Prior to re-submittal, a purchase order shall be delivered to the Engineer before additional reviews of submittal shall be performed.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 16050 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Recommended renewal parts list
3. Final as-built drawings
4. Complete wiring diagrams and approved submittals
5. Testing results

1.6 RECORD DOCUMENTS

A. The As-Built drawings shall include three (3) complete sets of full-size contract base sheet drawings with any and all changes included and noted. The As-Built drawings shall be kept up to date continuously by the electrician in charge of the system installation. These drawings shall be reviewed on a weekly basis for accuracy and completeness.

B. The Operation and Maintenance Manual shall include a complete set of equipment, component and device specification and data sheets, as well as a reduced size paper copy (11 x 17) of the complete set of system drawings described in specification section 1.5 A. The manual shall be bound in a black three ring loose leaf binder with dividers and a table of contents. Three (3) duplicate sets of Operation and Maintenance Manuals are required.

C. All documents and items described above shall be submitted for approval and turnover prior to the final testing and acceptance of system.

1.7 ACCEPTANCE OF SYSTEM

A. Final acceptance of the system will only be made after the required tests have been performed, the system has been found to perform satisfactorily, and the complete record document package has been submitted and approved.

1.8 GUARANTEE

A. Guarantee all labor, materials, and equipment provided under this contract against system defects for a period of one (1) yearafter the date of final acceptance of this work by the Owner.

B. Contractor must be pre-certified by the manufacturer(s) of the products that comprise a partnership guaranteeing 20 years performance.

C. All cabling, outlets and termination patch panels used shall be provided by a single manufacturer and shall be certified as part of the 20-year minimum warranty. Where the installer chooses to use one manufacturer for cabling and a different manufacturer for the outlets and termination patch panels for the telephone and data system(s), the two (2) manufacturers must prove to have compliant interconnecting hardware and shall be certified as part of the 20 year minimum warranty. A single supplier shall take responsibility for the end to end system performance certification and warranty.

1.9 FUNCTION AND OPERATION

A. The intended function of the telecommunication system(s) is to transmit data and/or voice signals from a central location to the individual data outlet locations. Upon completion of the work outlined in this specification, systems shall be capable of transmitting data signals in compliance with Gigabit Ethernet performance standards, regardless of the initial speed of network operation implemented by the Owner.

B. Voice and data distribution systems shall provide the same Category rating/level of performance unless specifically noted or specified otherwise.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Cable Manufacturers:

1. Hubbell
2. Corning (Fiber Optic Cable Only
3. Optical Cable Corporation (Fiber Optic Cable Only)
4. Seimon

B. Acceptable Outlet Manufacturers:

1. Hubbell
2. Siemon
3. Systemax
4. Panduit

C. Throughout this specification section, components are specified by manufacturer’s name and model number as basis of design in order to establish standards of quality and performance and not for the purpose of limiting competition.

D. Manufacturers submitted by the bidder as equals (or substitutions) to the basis of design shall comply with the requirements for substitutions in specification Section 16050 and the following:

1. The equipment to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

a) A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by the Engineer, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

b) The supplier shall furnish evidence that the proposed or alternate system performance is equal or superior to the system operation stated in the specification. Such evidence shall be submitted to and accepted by the Engineer, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

c) The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written, and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point by point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

d) The acceptability of any alternate proposed system shall be the sole decision of the Engineer.

2.2 GENERAL

A. All components required for a complete and first class installation shall be provided whether or not enumerated herein. Model numbers given are meant to set a standard for quality of construction, electrical characteristics required and general style of device. It is the Systems Integrator’s responsibility to verify the completeness and proper fit of devices including depth, and necessary cable bend radius within raceways, and compatibility of outlets in surface raceway or floor boxes before installation.

B. Verify device color selections with Architect and/or Owner.

C. All products shall be new, and brought to the job site in original manufacturer’s packaging. Electrical components (including innerduct) shall bear the Underwriter’s Laboratories label. All telecommunications cable shall bear the applicable flammability testing ratings as follows:

1. CM Communications Cable
2. CMP Plenum Rated Communications Cable
3. CMR Riser-rated Communications Cable

D. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket, which would indicate possible problems. Damaged cabling, or any other components failing to meet specifications shall not be used in the installation.

2.3 STATION CABLING (TELEPHONE & DATA HORIZONTAL CABLING)

A. Category 6 100 OHM balanced UTP Cable – 550 MHZ plenum

B. Design requirements

1. Cable construction shall be four twisted pairs of 23 AWG insulated solid conductors, with a ripcord, surrounded by a tight outer jacket.
2. Cable shall be manufactured with an “X”-shaped pair-divider along the center to maintain separation of individual pairs.
3. Conductor diameters shall be 0.0224” ± .0003” solid copper.
4. Conductor insulation diameter shall be 0.039” ± .0005” fluoro copolymer.
5. Twist lay of each pair shall vary in a manner to optimize noise immunity and minimize crosstalk.
6. Outer jacket diameter shall be 0.235” ± .008” low smoke PVC, with a nominal wall thickness of 0.015”.
7. Ripcord shall be directly underneath the outer jacket.
8. UL, ETL, or CSA agency certification or verification markings shall be marked on the cable jacket according to the certifying agency’s requirements.
9. Color coding of the pairs shall be as follows:
   a) Pair 1: White/Blue; Blue
   b) Pair 2: White/Orange; Orange
   c) Pair 3: White/Green; Green
   d) Pair 4: White/Brown; Brown
10. Cable shall be supplied in 1000 ft spools or 1000 ft Reelex boxes.

C. Performance Requirements

1. All transmission performance parameters shall be independently verified by a UL or ETL third party testing organization.
2. Cable shall exceed Category 6 transmission requirements specified in ANSI/TIA/EIA-568-C.2, and shall be tested through 550 MHz.
3. Cable shall exceed the requirements of TIA/TSB-155: 10 Gb/s Ethernet Operation over 55 Meters Channel Length.
4. Worst-case cable performance shall be +8.0 dB headroom over current TIA/EIA and ISO standards limits for NEXT and PSNEXT loss, and ELFEXT and PSELFEXT loss.
5. Insertion loss shall be 3.0% lower than standard Hubbell Category 6 plenum and riser cables described in Section 27 15 13.
6. Worst case electrical performance characteristics shall be as follows:
   a) Characteristic Impedance: 100 + 15 □ (1.0-100 MHz) 100 + 20 □ (101-250 MHz)

b) Maximum Conductor Resistance: 9.38 □ /100 Meters @ 20°C

c) Maximum Resistance Unbalance: 3%

d) Maximum Mutual Capacitance: 5.6 nF/100 Meters @ 1 kHz

e) Maximum Capacitance Unbalance: 330 pF/100 Meters

f) Maximum Delay Skew: 25 ns/100 Meters

7. The manufacturer shall provide Category 6 component compliance certificates from third party testing organization upon request.
8. Cable shall be UL and c (UL) listed.
9. Cable shall exceed IEEE 802.3 DTE Power specification to 4 times the rated current limits with no degradation of performance or materials.
10. Cable shall be third party verified, error free Gigabit Ethernet performance to IEEE 802.3 standard.
11. Cable shall meet or exceed the 4-connector channel performance requirements of Category 6, per the ANSI/TIA/EIA-568-C.2 standard.
12. The 4-connector channel test configuration shall utilize Category 6 jacks and patch panels, with Category 6 patch cords, from the same manufacturer, with qualified Category 6 cable.
13. The 4-connector channel performance margins in the table below shall be guaranteed provided the configuration satisfies requirement No. 12 above.

Electrical Parameter (1 - 250MHz)	Guaranteed Margins to Category 6 / Class E Channel Specifications
Insertion Loss	3 %
NEXT	4 dB
PSNEXT	5 dB
ELFEXT	4 dB
PSELFEXT	5 dB
Return Loss	2 dB

D. Acceptable Manufacturers:

1. Hubbell Premise Wiring.
2. The Hubbell products listed in the table below comply with all requirements specified in this document

HUBBELL CATALOG NUMBER	DESCRIPTION
C6SPxx	NEXTSPEED Category 6 550 MHz – Plenum Spool
C6RPxx	NEXTSPEED Category 6 550 MHz – Plenum REELEX

xx = Cable color. Replace xx with “W” for White, “GY” for Gray, “B” for Blue, “Y” for Yellow. Refer to project drawing for color applications.

3. Or approved equal.

2.4 STATION HARDWARE (OUTLETS)

A. Refer to specification section for Wiring Devices and for outlet boxes.

B. Category 6 Jack Requirements

1. All transmission performance parameters shall be independently verified by a UL or ETL third party testing organization.
2. Category 6 jacks shall exceed Category 6 transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-C.1, Transmission Performance Specifications for 4-Pair 100 ohm Category 6 Cabling.
3. The manufacturer shall provide Category 6 component compliance certificates from third party testing organization upon request.
4. Jacks shall be standard 8-position, RJ-45 style, un-keyed, FCC compliant.
5. Jacks shall be designed for 4-pair, 100 ohm balanced unshielded twisted pair (UTP) cable.
6. Each jack shall be single unit construction, with snap – fit to industry standard keystone opening (.760” x .580”).
7. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
8. Modular jack contacts shall accept a minimum of 2000 mating cycles without degradation of electrical or mechanical performance.
9. Jack termination method shall follow the industry standard 110 IDC punch-down
10. Jacks shall terminate 26-22 AWG solid or stranded conductors.
11. Jacks shall terminate insulated conductors with outside diameters up to .050”.
12. Jacks shall be compatible with ANSI/TIA/EIA-606-A color code labeling.
13. Jacks shall accept snap-on icons for specific identification.
14. Jacks shall be available in various colors to meet specific customer applications.
15. Jacks shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
16. Category 6 jacks shall be backward compatible with existing Category 3, 5, and 5e cabling systems for fit, form, and function.
17. Acceptable Manufacturers:
    a) Basis of Design - Hubbell Premise Wiring or approved equal
    b) The Hubbell products listed in the table below comply with all requirements specified in this document

CATALOG NUMBER	DESCRIPTION
HXJ6xx	NEXTSPEED® Category 6 Jack

xx = Jack color. Replace xx with “W” for White, “BK” for Black, “B” for Blue, “GY” for Gray, “GN” for Green, “OW” for Office White, “OR” for Orange, “R” for Red, “Y” for Yellow. Refer to project drawing for color applications

C. Face Plates and Angled Modules

1. Front loading faceplates shall utilize angled modules to minimize cable strain and bend angle inside the outlet box.
2. The basis of design for station angled wall plates is the Hubbell iSTAION modular faceplate frames with 1.5Unit angled keystone modules.

3. Refer to outlet schedule on the Drawings for port quantity per outlet type
4. Faceplates shall be constructed of high impact, UL94 V-0 rated thermoplastic.
5. Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm) for single gang and 4.5” X 4.5” (114.3 X 114.3 mm) for double gang.
6. Faceplates shall accept angled modules loaded with Hubbell Category 6 HXJ6 Series jacks.
7. Faceplates shall provide for ANSI/TIA/EIA-606-A compliant workstation outlet labeling.
8. Faceplates shall be provided with clear plastic and color-matched label field covers.
9. Two #6-32 pan head Phillips/slotted mounting screws shall be included with each single gang faceplate.
10. Four #6-32 pan head Phillips/slotted mounting screws shall be included with each double gang faceplate.
11. Faceplate modules shall snap firmly into front of
12. Color-matched Snap-In blank inserts shall be available separately to fill unused openings as required.
13. Faceplates shall be compatible with standard NEMA openings and boxes.
14. Faceplates shall be compatible with raceway fittings, surface mount boxes, service fittings, service poles, flush mount boxes and drywall rings
15. Acceptable Manufacturers:
    a) Basis of Design - Hubbell Premise Wiring or approved equal
    b) The Hubbell products listed in the table below comply with all requirements specified in this document

CATALOG NUMBER	Description
IMF1xx	1-Gang, Modular Face Plate
IMF2xx	2-Gang,Modular Face Plate
IM1KA15xx	1-Port Angled Module- White
IM2KA15xx	2-Port Angled Module- White
IMB15xx	1-Port Angled Module- White

xx = Faceplate color. Replace xx with “W” for White, “BK” for Black, “B” for Blue, “GY” for Gray, “GN” for Green, “OW” for Office White, “OR” for Orange, “R” for Red, “Y” for Yellow. Refer to project drawing for color applications

D. Telephone and data jack colors shall be as designated by the owner.

E. At each outlet location, provide the quantity of telephone and/or data jacks indicated on the drawings, unless otherwise noted.

F. Provide blank inserts for unused openings.

G. Verify all color selections with Architect/Owner

H. Voice-Grade Wall Mount Telephone Jacks:8-position, 8-conductor modular jack with stainless steel wall plate for hanging a phone, as manufactured by Hubbell or approved equal.

I. Standard mounting height modular telephone jacks shall be RJ11 type, with wall plate as previously specified, as manufactured by Pass & Seymour or approved equal.

2.5 BACKBONE CABLING – INTRABUILDING MULTI-PAIR COPPER CABLE

A. Provide cables as noted on the drawings. Cables shall be plenum rated Type CMP, Category 3 compliant, #24 AWG solid copper conductors with flame-retardant overall outer jacket.

B. Backbone cable runs and terminations, installation and testing are the responsibility of this Contractor. Risers as detailed on the project drawings include cables from the main telephone demarcation point/entrance facility to the MDF; and from the MDF to each IDF.

2.6 BACKBONE CABLING – OUTDOOR AND/OR INDOOR FIBER OPTIC CABLE

A. The basis of design for fiber optic cable is the OptiChannel series as manufactured by Hubbell Premise Wiring, in types and strand counts indicated on the drawings.

B. Cable shall be UL listed type OFNP (plenum) and OFNR (riser) rated to enable installation to go directly from outside plant to riser shaft with no transition point.

C. Outside plant cable shall be flexible, loose tube design of all dielectric construction, and utilize dry water-blocking technology. Each buffer tube and fiber shall be color-coded.

D. Outside plant cable consisting of 12 strands or less shall have a minimum installation pull strength of 300 lbs. Outside plant cable consisting of more than 12 strands shall have a minimum installation pull strength of 600 lbs. Drop cable minimum installation pull strength shall be 300 lbs.

E. 50 μm MM (multimode): OM3. Maximum attenuation (insertion loss) shall be 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm; bandwidth shall be 500 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

2.7 FIBER OPTIC CABLE TERMINATIONS (LC)

A. Connectors, optical fiber, LC Pre-polished

B. Design requirements

1. Connector basic design shall be a factory pre-polished LC optical fiber connector with a zirconium ceramic ferrule. Integral with the connector body is a wedge-activated fiber clamping mechanism to secure the inserted fiber into a mechanical splice with the factory installed cleaved fiber stub. Index-matching gel is supplied factory-injected into the cleaved fiber stub splice to optimize transmission performance. Connector attachment is achieved without tools, by inserting a field-cleaved optical fiber and then extracting the disposable clamp wedges from the connector body.

2. Each basic connector unit delivered shall consist of: (1) connector body with disposable clamp wedge, (1) strain relief boot, and (1) plastic dust cap.

3. LC multimode factory pre-polished connectors shall be available with either 50 micron, 62.5 micron, or 50 micron laser optimized pre-installed fiber.

4. LC pre-polished connectors shall also be available with singlemode pre-installed fiber.

5. Connector termination method shall utilize an industry standard multi-layer strip tool and bare fiber cleave tool as the only field tools required.

6. LC connectors shall have features to enable field verification using a visual fault locator (vfl) during termination.
7. Connector materials shall be designed with thermal stability to comply with environmental requirements of ANSI/TIA/EIA-568-b.3 and Telcordia gr-1081-core.
8. Multimode and singlemode pre-polished fiber connector materials shall be as follows:
   a) Ferrule: zirconium ceramic
   b) LC inner body: thermally stable injection molded thermoplastic
   c) Dust cap: nylon or pvc
   d) Strain relief boot: ul94-v0 molded pvc
9. Pre-polished LC connectors shall require no field polishing.
10. Pre-polished LC connector body shall be industry standard colors for specific applications, as designated below:
    a) 62.5 micron multimode: beige
    b) 50 micron multimode: black
    c) 50 micron multimode, laser optimized: aqua
    d) Singlemode: blue
11. Pre-polished LC connectors, either multimode or singlemode, shall require no adhesives for termination.
12. LC connector internal fiber clamping mechanism shall firmly secure both the inserted glass fiber and the 900 micron buffer layer of the inserted fiber for maximum strain relief.
13. All standard mating and interface dimensions for lc connectors shall comply with ANSI/TIA/EIA -604-10 (Focis 10).
14. Ferrule outside diameter for LC multimode connectors shall be 1.2467mm to 1.2497mm.
15. Ferrule outside diameter for LC singlemode connectors shall be 1.2483mm to 1.2497mm.
16. LC ferrule tip shall have a pc spherical radius of approximately 7.0 mm radius for multimode and singlemode versions.
17. Delivered connectors shall be individually bagged with the dust cap installed to protect from contamination.
18. Delivered connectors shall have the disposable clamp activation wedge element pre-installed onto the connector body.
19. Connector design and termination technique shall be independent of cable type or manufacturer, and shall be compatible for either 900 micron buffer or 250 micron buffer distribution cables.
20. LC connector strain relief boot shall be a Telcordia style slotted design for maximum flexural strain relief.
21. Strain relief boot shall be black for multimode, and yellow for singlemode.
22. LC connectors shall be available individually bagged in packs of 12.

C. Performance requirements

1. Pre-polished LC fiber connectors, when properly installed onto qualified cable, shall meet the 10 gb/s ethernet performance requirements of ieee802.3.
2. Pre-polished LC fiber connectors, properly installed onto qualified cable, shall exceed the mechanical and environmental performance requirements of ANSI/TIA/EIA -568-c.3, annex 'a'.
3. Pre-polished LC fiber connectors, properly installed onto qualified cable, shall exceed the mechanical and environmental performance requirements of Telcordia gr-1081-core.
4. Qualification test data shall be available from the manufacturer upon request.

D. Products specified - Hubbell premise wiring part numbers

1. The Hubbell pre-polished fiber connectors, tools, and accessories in the tables below comply with all requirements specified in this document.

CATALOG NUMBER	Description
FCLC900K50M12	LC Multimode, 50 Micron OM2, Black Housing
FCLC900K50GM12	LC Multimode, 50 Micron Laser Optimized OM3, Aqua Housing
FCLC900KSM12	LC UPC Singlemode, Blue Housing
FCLC900KASM12	LC APC Singlemode, Green Housing

2.8 PATCH CORD ASSEMBLIES

A. The basis of design Cat 6 patch cord assembly is Hubbellcatalog number HC6 Series Patch Cords.

B. Cat 6 patch cords shall be factory-manufactured in 5-foot, 10-foot, and 15-foot lengths, with booted connectors. Provide one (1) patch cord for each outlet (40% 5-foot lengths, 40% 10-foot lengths, and 20% 15-foot lengths).

C. The basis of design 50 µm MM fiber optic patch cord assembly is Hubbellcatalog numberDFPCSCSCD2MM. Patch cord shall be 2 meters long, duplex density, and SC to SC connector style.

D. Provide the required quantity of fiber optic patch cords for the application. Provide minimum of two fiber patch cord assemblies for each type of fiber (50 MM) used in each IDF location.

2.9 MDF/IDF TERMINATION HARDWARE

A. The telephone and data station cables shall be terminated on Category 6 48 position modular jack patch panel(s) with circuit board construction in all MDF/IDF locations.

B. Category 6 Patch Panel Reqirements

1. All transmission performance parameters shall be independently verified by a UL or ETL third party testing organization.
2. Category 6 panels shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-C.2 Transmission Performance Specifications for 4-Pair 100 ohm Category 6 Cabling.

3. The manufacturer shall provide Category 6 component compliance certificates from third party testing organizations upon request.
4. Category 6 patch panels shall be standard 8-position, RJ-45 style, un-keyed, in 48-port configurations.
5. Panel frames shall be 14-gage steel with rolled edges top and bottom for proper stiffness.
6. Panel design shall incorporate plastic push-fasteners to permit hands-free positioning onto standard EIA-310-D 19” mounting rails.
7. Panels shall accommodate a minimum of 24 ports for each rack mount unit (1 RMU = 1.75 in.).
8. Panels shall be designed for 4-pair, 100 ohm balanced unshielded twisted pair (UTP) cable.
9. Panels shall terminate 26-22 AWG solid conductors, with maximum insulation diameter of 0.050 in.
10. Panels shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
11. Panels shall have individual port identification numbers on the front and rear of the panel.
12. Panel adapter modules shall be 110-style termination with tin lead solder plated IDC contacts.
13. Printed circuit boards shall be fully enclosed front and rear for physical protection.
14. Panel contacts shall withstand a minimum of 2000 mating cycles with an FCC 8-position RJ-45 plug, without degradation of electrical or mechanical performance.
15. Panel contacts shall be constructed of Beryllium copper for maximum spring force and durability.
16. Contact plating shall be a minimum of 50 micro-inches of hard gold in the contact area over 50 micro-inch of nickel.
17. Panel termination method shall follow the industry standard 110 IDC punch-down, using a standard 110 impact termination tool.
18. Panels shall be compatible with a 4-pair multi-punch impact termination tool designed specifically for the purpose. Bending or other damage to the panel using a multi-pair punch tool shall not occur.
19. Panels shall not require special cords, specialty tools or special installation requirements.
20. Panel ports shall accept optional hinged dust covers and port identification icon buttons.
21. Space above the adapter ports shall be available for additional labeling per ANSI/TIA/EIA-606-A.
22. Category 6 panels shall be backward compatible with existing Category 3, 5, and 5e cabling systems for fit, form, and function.
23. Panels shall accept a clip-on rear cable management support bar to provide cable strain relief.
24. Acceptable Manufacturers:

a) Hubbell Premise Wiring or approved equal.

b) The Hubbell products listed in the table below comply with all requirements specified in this document

CATALOG NUMBER	Description
HP648	NEXTSPEED® Category 6 Patch Panel, 48-Ports
Comes with	Rear Cable Management Bar

C. The contractor is responsible for all equipment cabinets, patch panels, and cable management panels for all MDF/IDF layouts and equipment rack configurations. Provide a minimum of 20% spare ports in patch panels for each system.

D. Provide separate, dedicated patch panels for telephone and data cabling. Include spare capacity in patch panel fields provided for each system as specified. Label each patch panel field to readily identify the associated system.

E. The basis of design horizontal cable manager is Hubbell catalog number HM24.Cable Management Panels: Horizontal managers shall have 7 rings and provide the capability to organize and contain up to ninety-six (96) patch cords on the front of the panel. The front of the panel shall provide five (7) high capacity 3.5” x 3.5” horizontal distribution rings to reduce stress on stored cables to retain optimal cable geometry. All distribution rings shall have radius edges to protect cables from nicks and tears. The cable manager shall be no more than 2RU high, and shall fit a standard 19” rack.

F. Provide equipment cabinets in the MDF and equipment racks in the IDF location(s) indicated on the drawings, and as required to terminate all outlets/cables indicated on the drawings.

1. The contractor shall determine the layout, configuration and appropriate quantity of equipment cabinets/racks, patch panels, cable management panels, etc. for all MDF/IDF locations. MDF/IDF layouts/configurations shall be coordinated with and approved by the Owner prior to ordering of equipment or commencing installation.

2. Each 77” cabinet or rack shall have no less than 22 empty spaces (38.5”). Free-standing cabinets/racks shall be bolted to floor with all cables entering through the top via conduit or cable tray.

G. MDF equipment cabinets shall be 24.25” wide and 31.5” deep with standard 19” panel mounting width and 77” equipment mounting height. The basis of design is Hubbell Premise Model # H2N8432 with Model #H2KNF fan kit

H. IDF equipment racks shall be of the open, cable management type, with vertical cable raceway, 16.5” deep with standard 19” panel mounting width and 77” equipment mounting height. The basis of design is B-Line Model # SB813084FB Equip with one (1) shelf per rack for future equipment, and all necessary rails and mounting hardware.

I. In each MDF/IDF, provide one (1) UPS system. The basis of design is the Eaton Model # 5PX1500RT.

J. Equipment Cabinet/Rack Grounding: Install bonding conductor between cabinet/rack and telecom grounding busbar (TGB) in accordance with applicable codes, ANSI/TIA/EIA-607, NEC, and the requirements of specification section 16450, Grounding.

K. Terminal Boards: Provide ¾” thick exterior-grade plywood equipment mounting backboards, height and width as shown on the drawings. Paint plywood on both sides with (2) coats of fire-retardant paint, color to be white or as otherwise selected by Owner.

3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install telecommunication distribution systems in accordance with requirements of Section 270500 and manufacturer’s recommendations.
2. Install telephone and/or data cables from outlets shown or drawings or otherwise required to nearest MDF/IDF location unless indicated otherwise. In general, cables shall be terminated in an MDF/IDF located on the same floor as the outlet.
3. Provide 30’-0” of additional slack, or sufficient slack to reach the farthest point within the room served, in each cable run to accommodate future moves or changes.
4. Avoid penetration of fire rated walls, ceilings, etc. Where this is not feasible, reseal penetrations (including those in sleeves) with an Underwriter’s Laboratories (UL) approved sealant material. Seal all floor, ceiling, and wall penetrations in the wiring closets.For new installations through fire rated walls, provide *Flamestopper* thru wall fitting as manufactured by Wiremold (size as required for each location).
5. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

B. Grounding: Install telecommunication systems grounding and bonding in accordance with ANSI/TIA/EIA-607, latest edition of NEC, requirements contained in specification section 260526 Grounding, and per manufacturer’s recommendations.

C. Labels:

1. The labeling plan shall be developed by the Contractor and approved by Owner/Engineer. The Contractor will label all outlets following the detailed shop drawing design, using permanent/legible typed or machine engraved labels. Terminals in MDF/IDFlocations or telecom closets shall be labeled by the Contractor using designation strips as applicable to terminal hardware. All copper/fiber terminals for riser cables shall correspond to terminal numbering in the MDF.
2. The labels on station terminals shall be numerically sequential. Outlets shall be labeled to match the labels on the corresponding terminal position. Patch panel labels shall include a room number component and a sequential extension. The room number component shall reflect the numbering system utilized for door labels or room numbers.
3. A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.
4. Labels shall correspond to as-built and to final test reports.
5. Labels shall be mechanically generated. Handwritten labels are not acceptable.

D. Wiring Methods:

1. The entire installation shall be concealed in the construction except that it may be run exposed in unfinished areas and telecom/electrical rooms. Obtain prior approval from Architect/Owner for exposed portions of installation.
2. Telecommunication cabling/conduit, including Fiber Optic cables, shall NOT be installed underground without engineer's approval. Any cabling installed below grade shall have a moisture resistant jacket, regardless of model numbers otherwise specified herein.
3. All cabling installed in return air plenums shall be plenum rated.
4. Above suspended ceilings or in other non-exposed areas, install cables within J-hooks (sized as required). Fasteners shall be placed at random intervals no greater than 60 inches and preferably on 48 inch centers. Cable sag between supports shall not exceed 8 inches.
5. Where wiring enters or travels through walls, floors, etc., or is subject to physical damage, it shall be installed in metallic conduit.
6. Provide minimum 2" sized metallic conduit sleeves above ceilings between non-rated corridors and areas where data outlets are located, and elsewhere where required to install data cabling. Provide adequate quantity of sleeves required for all cables.
7. The fill shall not exceed 40 percent for cable pathways (raceways, cable trays, j-hooks, sleeves, etc.).
8. Cables and associated hardware shall be placed so as to make efficient use of available space in coordination with other trades and uses. All cables and associated hardware shall be placed so as not to impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).
9. Cables shall be supported in accordance with TIA/EIA-569-B and the latest BICSI requirements. Cables shall not be fastened to or supported from any other building system (for example: electric conduits, sprinkler lines, ductwork, etc.). Cabling shall not rest on suspended ceilings, be fastened to ceiling support wires, or be installed near steam piping or over light fixtures.
10. Cables shall be routed to avoid light fixtures (18 inches minimum spacing), sources of heat (12 inches minimum spacing), and power cables or conduits (16 inches minimum spacing unless cables are installed in shielded trays or approved conduits). Cables must be spaced a minimum 120 inches (10 feet) from bus duct.
11. Cables must be handled with care during installation so as not to change performance specifications. The Contractor shall not over tighten tie wraps or over bend the cable. Creased or kinked cables will not be accepted and will be replaced at the Contractor's expense.
12. Install cables to minimize overall length. Generally, maximum cable length between telecom closet and the workstation shall not exceed 295 ft.
13. Maintain twists in cable pairs as close to the termination as possible. Do not untwist cable pairs more than 0.5" when terminating.
14. Do not exceed cable bend radius (not less than four times the outer diameter of the cable for standard, 4-pair UTP cable). For multi-pair cables (more than four pairs), the minimum bend radius shall not be less than ten times the outside diameter of the cable.

15. Provide a 12-inch service loop at the outlet on each cable. Provide service loop in cable at Backboard/Equipment Rack location as specified hereinafter.

E. Fiber Optic Cable installation: In addition to the above wiring method requirements, the following shall apply:

1. Interior fiber optic cables shall be installed with nylon pull line in 2” EMT conduit. Conduit shall extend between data closets and turn down into the tops of the data racks.
2. Armored fiber optic cable may be utilized, installed without EMT conduit, above ceilings in existing construction.
3. Provide a minimum 10-foot service loop at each end of every fiber optic cable.
4. At each location where fiber cables are exposed to human intrusion, mark cables with warning tags. Tags shall be orange in color and shall read, “CAUTION: FIBER OPTIC CABLE”. The text shall be permanent, in black, block letters; and shall be at least 3/16” high. Permanently affix a warning tag to each exposed cable or bundle of cables at intervals not to exceed 5 feet.

F. Backboard Cabling/Equipment Rack Configuration

1. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, network equipment mounting access hatches to air filters, switches or electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings. Provide a minimum of 36 inches for a service loop to the patch panel.
2. Cable shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Cables shall not be tie-wrapped to electrical conduit or other equipment. Minimum bend radius shall be observed.
3. Lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Lace or tie-clamp all similarly routed cables together, and attach by means of clamps screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via “square” corners over a path that will offer minimum obstruction to future installations of equipment, backboards, or other cables.

3.2 TESTS

A. Test all cables and certify compliance with manufacturer’s standards for a 20-year warranty. All test results shall be printed directly from the tester to Adobe Acrobat and stored on CD-ROM in PDF format. All tests including failures shall be stored. Re-tests and cables replaced for compliance shall also be stored on the same CD-ROM.

B. Before requesting a final inspection, the Contractor shall perform a series of end to end installation performance tests. The Contractor shall submit for approval a proposal describing the industry standard test procedures, test result forms, and timetable for fiber optic and all copper plant wiring. Contractor shall notify engineer to allow witness of testing procedures.

C. Acceptance of the sample test procedures discussed is predicated on the Contractor’s use of the recommended products (including but not limited to twisted pair cable, patch

panels, and outlet devices specified in the Products section) and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.

D. Test Criteria: The system shall be tested to Category 6 compliance. The test path shall include workstation jacks, station cables, patch panels, and adapter cables. Test shall be performed with a Fluke MicrotestOMNI-Scanner or equivalent product. Tester must have minimum dynamic range of 87dB and scan to at least 300MHz.

E. The Contractor shall test:

1. All station drop cable pairs from termination patch panels to outlet device 8 position modular jacks.
2. All backbone cabling.

F. Each wire/pair shall be tested at both ends up to 250MHz for the following:

1. Termination order
2. Polarity (pair reversals)
3. Continuity
4. Shorts
5. Grounds
6. NEXT (near end cross talk) from both directions
7. Cable length (record all length)
8. Attenuation
9. Return Loss
10. ELFEXT from both directions

G. When errors are found, the source of each error shall be determined, corrected, and the cable re-tested. All defective components shall be replaced and retested at Contractor's expense. Defective components not corrected shall be reported to the Owner/Engineer with explanations to the corrective actions attempted.

H. Owner's representative will observe and verify the accuracy of test results submitted, and reserves the right to randomly check any connection prior to acceptance.

I. Fiber Optic Testing:

1. Each fiber strand shall undergo bi-directional testing for signal attenuation losses.
2. Test Equipment: Light Source and Level III Power Meter manufactured by MicroTest (Certifiber), Wavetek, Tekronix, or Noyes Fiber Systems.
3. Test Criteria: Connector maximum attenuation (insertion loss) shall be 0.75 dB per termination.
4. All testing shall be performed by trained personnel.
5. All installed fiber optic cable EIA 455-171 Method D procedures will be adhered to. (Bi-directional).
6. The Fiber Optic Cable shall not exceed 4dB per kilometer tested at 850nm and 2dB per kilometer tested at 1300nm for multimode 62.5/125 fiber.
7. The contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer's specifications.

3.3 FIELD ADJUSTMENTS

A. Replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over twisted pairs at terminals, and sheath removed too far.

B. Perform field adjustments to obtain proper functioning as required to place the equipment in final operating condition in accordance with the contract documents.

C. Necessary field adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the owner.

3.4 DOCUMENTATION

A. Contractor shall provide documentation to include test results and as-built drawings.

3.5 MINIMUM WARRANTY

A. Cabling Systems shall meet the performance requirements of the TIA/EIA-568-C.2 standards. The warranty on the material, services, and operation of the cabling system to this specification must be for a period of at least 20 years.

B. The warranty must include the following statements regarding the cabling system:

1. “Support and conform to TIA/EIA-568-C.2 specifications covering ANY CURRENT OR FUTURE APPLICATION which supports transmission over a properly constructed horizontal cabling system premises network which meets the channel and/or basic link performance as described in TIA/EIA-568-C.2.

2. “Be free from defects in material or faulty workmanship”.

C. The warranty must be provided by either the cable manufacturer or the hardware manufacturer, and must be fully executed prior to project closeout.

END OF SECTION

SECTION 272727 – SPECIAL SYSTEMS WIRING DEVICES

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wiring devices for special systems; complete, ready for operation, including all necessary parts, accessories, connections, wiring and equipment. Refer to individual system sections for special wiring device specifications. Types of special system wiring devices in this section include the following:

   a) AV System Devices in Bowman Center Dining/Activity 203

1.2 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the manufacturer for both installation and maintenance of the system required for this project.

1. Contractor, and service organization, if applicable, shall be located not more than 100 miles from the project site

B. The telecommunication systems, including all necessary parts, accessories, connections and equipment, shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards, including all currently approved addenda issued to date:

1. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises
2. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard
3. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling And Components Standard
4. TIA-569-B “Commercial Building Standard for Telecommunications Pathways and Spaces”
5. TIA/EIA-606-A “Administration Standard for Commercial Telecommunications Infrastructure”
6. TIA/EIA-854 “Full Duplex Ethernet Specification for 1000Mbis/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling”
7. J-STD-607-B “Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications”
8. Building Industry Consulting Service International (BICSI).
9. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC).
10. National Electrical Manufacturers Association (NEMA).
11. Underwriters Laboratory (UL) listed and labeled.

12. Institute of Electrical and Electronics Engineers (IEEE).

13. Federal Communications Commission (FCC).

C. All products provided shall be newly manufactured. All equipment proposed as part of the system shall be in current manufacture, off the shelf and not one of a kind, and supported by the Contractor and Manufacturer.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 270000 and General Conditions of Contract:

1. Provide complete submittals, which shall include: floor plan drawings indicating device locations and label/identification nomenclature; schematic wiring drawings; elevation views of equipment racks, cabinets, and components; and spec sheets for all equipment.

   a) Partial submittals will not be accepted.

   b) Spec sheets shall include data on features, ratings, and performance. Components must show compliance with the performance criteria specified herein.

2. Provide copy of Contractor's factory certification and manufacturer's 20-year performance warranty.

3. Upon request, show record of at least ten (10) previous projects of this type with required warranties.

B. If re-submittals are required, they shall be provided within two (2) weeks after the date of notification. If re-submittals are not received by the Engineer in two (2) weeks, the supplier will be considered nonresponsive and subsequent submittals from the supplier will not be reviewed. The Contractor shall then provide submittals from another equipment supplier within two (2) weeks as directed by the owner, at no change in contract price.

C. The cost of review of any submittals after two (2) submittals have been rejected shall be paid by the Contractor to the Engineer. Prior to re-submittal, a purchase order shall be delivered to the Engineer before additional reviews of submittal shall be performed.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 260050 and General Conditions of Contract:

1. Instruction books and/or leaflets

2. Recommended renewal parts list

3. Final as-built drawings

4. Complete wiring diagrams and approved submittals

5. Testing results

1.5 RECORD DOCUMENTS

A. The As-Built drawings shall include three (3) complete sets of full-size contract base sheet drawings with any and all changes included and noted. The As-Built drawings shall be kept up to date continuously by the electrician in charge of the system installation. These drawings shall be reviewed on a weekly basis for accuracy and completeness.

B. The Operation and Maintenance Manual shall include a complete set of equipment, component and device specification and data sheets, as well as a reduced size paper copy (11 x 17) of the complete set of system drawings described in specification section 1.5 A. The manual shall be bound in a black three ring loose leaf binder with dividers and a table of contents. Three (3) duplicate sets of Operation and Maintenance Manuals are required.

C. All documents and items described above shall be submitted for approval and turnover prior to the final testing and acceptance of system.

1.6 ACCEPTANCE OF SYSTEM

A. Final acceptance of the system will only be made after the required tests have been performed, the system has been found to perform satisfactorily, and the complete record document package has been submitted and approved.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. AV System Outlets and Wall Plates:

a) Pass & Seymour/Legrand

b) Hubbell

c) Leviton

d) Cooper

B. Throughout this specification section, components are specified by manufacturer’s name and model number as basis of design in order to establish standards of quality and performance and not for the purpose of limiting competition.

2.2 AV SYSTEM DEVICES

A. AV Device Plate (Device Location)

1. See telecommunication specifications

2. Provide (2) surge suppression duplex receptacles with coverplates in box.

a) Basis of Design: Hubbell #NSOKPS.

3. Provide (1) HDMI outlet.

a) Basis of Design: Hubbell # IMH110ST2W (display end) High-Definition 110 UTP Video Extender with coverplate and power supply.

b) Provide HDMI cable from outlet to device.

c) CAT6 cabling from HDMI display end to source end.

4. Provide (1) VGA outlet.

a) Basis of Design: Hubbell # IM15311015W (display end) with 3.5m audio over UTP with coverplate and power supply

b) Provide VGA cable and 3.5mm male connector cable from outlet to device.

c) CAT6 cabling from VGA display end to source end.

5. Provide (1) Data outlet with 2-outlets with coverplate.

a) See Telecommunications specs for outlet type.

b) (1) category cable shall run from IDF to outlet; provide cable from this outlet to projector.

c) (1) category cable shall run from IDF to terminate in outlet.

B. AV Accessory plate (Connectivity to Device)

1. Provide (1) 3-gang AV wallbox.

a) Basis of Design: Hubbell #HBL986.

b) Provide with low-voltage divider, Hubbell #HBL989

2. Provide (1) 3-gang Coverplate.

a) Basis of Design: Hubbell #IMFP1D2W.

3. Provide (1) HDMI outlet.

a) Basis of Design: Hubbell # IMH110ST2W (source end) High-Definition 110 UTP Video Extender with coverplate and power supply.

4. Provide (1) VGA outlet.

a) Basis of Design: Hubbell # IM15311015W (source end) with 3.5m audio over UTP.

5. Provide (1) Data outlet with 2-outlets with coverplate.

a) See Telecommunications specs for outlet type.

b) (1) category cable shall run from outlet to data outlet in TV box.

c) (1) category cable shall run from IDF to terminate in outlet.

6. Provide (1) IM2K1W 2 unit iStation module.

a) See this section for outlet type.

3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install telecommunication distribution systems in accordance with requirements of Section 270500 and manufacturer's recommendations.

2. Install cables from outlets shown or drawings or otherwise required to nearest MDF/IDF location unless indicated otherwise.

   a) In general, cables shall be terminated in an MDF/IDF located on the same floor as the outlet.

3. Avoid penetration of fire rated walls, ceilings, etc. Where this is not feasible, reseal penetrations (including those in sleeves) with an Underwriter's Laboratories (UL) approved sealant material. Seal all floor, ceiling, and wall penetrations in the wiring closets.

4. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

B. Grounding: Install telecommunication systems grounding and bonding in accordance with ANSI/TIA/EIA-607, latest edition of NEC, requirements contained in specification section 16450 Grounding, and per manufacturer's recommendations.

C. Labels:

1. The labeling plan shall be developed by the Contractor and approved by Owner/Engineer. The Contractor will label all outlets following the detailed shop drawing design, using permanent/legible typed or machine engraved labels. All copper/fiber terminals for riser cables shall correspond to terminal numbering in the MDF.

2. The labels on station terminals shall be numerically sequential. Outlets shall be labeled to match the labels on the corresponding terminal position. Patch panel labels shall include a room number component and a sequential extension. The room number component shall reflect the numbering system utilized for door labels or room numbers.

3. A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

4. Labels shall correspond to as-built and to final test reports.

5. Labels shall be mechanically generated. Handwritten labels are not acceptable.

D. Wiring Methods:

1. The entire installation shall be concealed in the construction except that it may be run exposed in unfinished areas and telecom/electrical rooms. Obtain prior approval from Architect/Owner for exposed portions of installation.

2. Telecommunication cabling/conduit shall NOT be installed underground without engineer's approval. Any cabling installed below grade shall have a moisture resistant jacket, regardless of model numbers otherwise specified herein.

3. All cabling installed in return air plenums shall be plenum rated.

4. Above suspended ceilings or in other non-exposed areas, install cables within J-hooks (sized as required). Fasteners shall be placed at random intervals no greater than 60 inches and preferably on 48 inch centers. Cable sag between supports shall not exceed 8 inches.

5. Where wiring enters or travels through walls, floors, etc., or is subject to physical damage, it shall be installed in metallic conduit.

6. Provide minimum 2" sized metallic conduit sleeves above ceilings between non-rated corridors and areas where data outlets are located, and elsewhere where required to install data cabling. Provide adequate quantity of sleeves required for all cables.

7. The fill shall not exceed 40 percent for cable pathways (raceways, cable trays, j-hooks, sleeves, etc.).

8. Cables and associated hardware shall be placed so as to make efficient use of available space in coordination with other trades and uses. All cables and associated hardware shall be placed so as not to impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).

9. Cables shall be supported in accordance with TIA/EIA-569-B and the latest BICSI requirements. Cables shall not be fastened to or supported from any other building system (for example: electric conduits, sprinkler lines, ductwork, etc.). Cabling shall not rest on suspended ceilings, be fastened to ceiling support wires, or be installed near steam piping or over light fixtures.

10. Cables shall be routed to avoid light fixtures (18 inches minimum spacing), sources of heat (12 inches minimum spacing), and power cables or conduits (16 inches minimum spacing unless cables are installed in shielded trays or approved conduits). Cables must be spaced a minimum 120 inches (10 feet) from bus duct.

11. Cables must be handled with care during installation so as not to change performance specifications. The Contractor shall not over tighten tie wraps or over bend the cable. Creased or kinked cables will not be accepted and will be replaced at the Contractor's expense.

12. Install cables to minimize overall length. Generally, maximum cable length between telecom closet and the workstation shall not exceed 295 ft.

13. Maintain twists in cable pairs as close to the termination as possible. Do not untwist cable pairs more than 0.5" when terminating.

14. Do not exceed cable bend radius (not less than four times the outer diameter of the cable for standard, 4-pair UTP cable). For multi-pair cables (more than four pairs), the minimum bend radius shall not be less than ten times the outside diameter of the cable.

15. Provide a 12-inch service loop at the outlet on each cable. Provide service loop in cable at Backboard/Equipment Rack location as specified hereinafter.

3.2 FIELD ADJUSTMENTS

A. Replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over twisted pairs at terminals, and sheath removed too far.

B. Perform field adjustments to obtain proper functioning as required to place the equipment in final operating condition in accordance with the contract documents.

C. Necessary field adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the owner.

3.3 DOCUMENTATION

A. Contractor shall provide documentation to include test results and as-built drawings.

END OF SECTION

SECTION 274115 – AUDIO-VIDEO SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Performance of all labor and providing and installing all materials, components and accessories as required for the construction of the project as indicated by contract documents.
2. Equipment specified in this section includes, but is not limited to the following:
   a) Community Center/Adult Daycare Dining/Activity and Living Areas Sound System
   b) Community Center/Adult Daycare Fitness Center Sound System
   c) Community Center/Adult Daycare Multi-Purpose Room Sound System
   d) Bowman Center Conservatory Sound System
      1) CD Player and headend in Dining/Activity 203
      2) Provide separate channel/CD player/AUX input to keep this system on a dedicated channel
   e) Bowman Center Dining/Activity 203

1.2 SUBMITTALS

A. Submit manufacturer’s product data, system drawings and wiring diagrams, etc. in accordance with requirements of Section 270500.

2 PRODUCTS

2.1 AUDIO – VIDEO SYSTEM:

A. Provide a complete, locally controllable sound system including assembly and performance mode operation, digital equalization, feedback filtering, CD Player, CD Recorder, Wireless microphones, and specifications as follows. The system shall be combined with all equipment in one rack allowing simultaneous independent operation of each space.

B. Note: All Equipment shall conform to the manufacturer's latest published specifications in feature and function both physically and electrically whether or not those specifications are delineated herein. The manufacturer's latest published specifications shall be considered as part of this text. Equipment shall be Allen & Heath, Audio-Technica, Architectural Acoustics, Ashley, Aviom, Biamp, BSS, Crown, DBX, Denon, EAW, Electro-Voice, JBL, Sabine, Shure, Soundcraft, Symetrix, Tascam, Telex, or Yamaha.

C. The Digital Signal Processor shall be provided with ten inputs. The processor shall be fed by the CD changer, one wireless microphone and auxiliary line input. The Digital Signal Processor Controller shall provide Gain Management/Limiter/ Equalizer/Delay/Mix Matrix functions for loudspeakers with inputs and outputs as listed. The processor shall

have programmable capability enhanced by full complement of audio devices available from a Win32 based Graphical User Interface (GUI). Audio processing devices available are, but not limited to: automatic mixers, crossovers, AGC, gates, limiters, expanders, duckers, delay lines, meters, mixers, routers, test signal sources, room and ring mode equalizers, and automatic "dynamic search and delete" feedback filters. The system shall have 24-bit A/D and D/A converters and RS-232/485 connection for remote serial control functions. The digital signal processor shall have a frequency response of ± 0.5 dB or better from 20 Hz to 20 kHz. Its total harmonic distortion shall be no more than 0.01% from 20 Hz to 20 kHz with a +4 dBu input signal and a +4 dBu output signal, both with 20 dB of headroom. It shall have a dynamic range of not less than 103 dB A-weighted. Input common mode rejection ratio (CMRR) shall be greater than 55 dB at any gain setting. The maximum input level without clipping shall be +30 dBu while maintaining the specified CMRR. The maximum output level shall be +24 dBu while still meeting the frequency response specification. The balanced input impedance shall be 6k ohm or higher. The balanced output impedance shall be 102 ohms and designed to drive 600 ohm loads or greater while maintaining the specified frequency response. Provide system with outputs for ceiling loudspeakers and AUX jack.

D. Power amplifiers shall be multi-speed fan cooled to reduce cleaning requirements. Provide Crown CTS series amplifiers or equal by Electro-Voice, QSC, or Architectural Acoustics. Amplifiers must have rear panel level controls.

E. The CD changer shall be Tascam Model CD200iL with rackmount located in the stage rack for assembly mode usage. The CD Player/Recorder shall be Marantz Model CDR510 with MP3 playback mounted in the performance mode mixer case.

F. All necessary power supplies, relays, connectors, and hardware necessary to provide remote switching functions as described shall be provided.

G. The AC Power control panel shall be rack mounted with front panel switch, rear panel outlets, and built-in surge/noise filtering. Provide sequential (amps on last off first and staged for inrush protection) remote power up from master volume control panel locations. Provide all power control outlets as required for locations and loads of equipment specified herein.

H. The above equipment shall be contained in a wall mounted equipment rack with locking front and rear doors. The racks shall be Middle Atlantic Products or equal by Lowell or Atlas/Soundolier. Provide additional cabinet space if necessary for adequate panel space with a single space vent panel separating each active device or manufacturer's recommendations for amplifier cooling. Cover spare space with matching blank panels.

I. Provide a rack mounted four (4) space storage drawer.

J. Provide one (1) Biamp RED1 remote control panels, each remote control panel shall provide level control of the selected assembly mode inputs/groups as well as master volume. Provide all required interface and make all required connections. Provide momentary key operated system power on and off switches next to each remote control panel. Provide Auxiliary Input jack at each location for MP3 input to sound system next to each remote control panel.

K. Sound systems shall integrate with projector; as required.

2.2 SOUND REINFORCEMENT SYSTEM LOUDSPEAKERS

A. Provide Community Model D8 – 8” high output two-way ceiling loudspeakers with white finish. Install in locations as shown on the plans.

B. Conservatory Speakers: Provide Community Model DS8 – 8” high output two-way wall mounted loudspeakers with white finish. Install in locations as shown on the plans. Provide with mounting brackets.

2.3 AUDIO – VIDEO SYSTEM (Community Center/Adult Daycare Multi-Purpose Room Sound System)

A. See Drawings for model numbers and wiring.

B. Provide a complete, locally controllable sound system including assembly and performance mode operation, The system shall be combined with all equipment in one rack allowing simultaneous independent operation of each space.

C. All wiring shall be in accordance with manufacturer’s recommendations.

2.4 MICROPHONES:

A. Multi-Purpose #212 Only.

B. Provide one (1) Audio-Technica Model AEW-R3100b agile UHF wireless mic system receivers. Provide rackmount hardware required. Provide one (1) Model ATW-T310b bodypack transmitters. Provide one (1) AT-831cW clip-on cardioid lavalier microphones. Provide rackmount hardware required. Provide necessary rack mount kits. Telex FMR1000 series and Shure ULXP Series shall be considered equal. All wireless microphones on the project shall be the same series for interchangeability.

2.5 REMOTE SYSTEM RECEPTACLES:

A. Multi-Purpose #212 Only.

B. All single microphone receptacles shall be Conquest Model CP1DF as being wall mounted.

1. One in front of room and one in rear of room.

a) Coordinate exact locations with owner prior to rough-in.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 270500. Comply with installation instructions provided by system manufacturer. Provide type of cables as shown on plans and schedules or as recommended by the manufacturer.

B. All wiring shall be plenum rated where required by code.

C. Install system to comply with drawings and final shop drawings in compliance with manufacturer's printed instructions.

D. Cable identification: shall be provided on both ends of each cable and termination with the owner’s room number and the wiring block or device to which it is connected. Tags shall be permanent and neat.

E. Furnish and install necessary conduit, raceways, pull boxes, outlet boxes and wire to provide a complete system or systems as herein specified. All wiring shall be tested for continuity and freedom of all grounds and short circuits.

F. The system supplier shall provide central intercom control consoles pre-wired for connection of all console system wiring to 66M150 punch block. The console cables shall be labeled according to speaker position. The electrical contractor shall provide a 24" by 48" by 6" deep junction box for all 66 block. The junction box shall be of ample size for all connections (including the punch block) and shall be mounted at the control equipment location.

G. Each cable run between the console and remote locations shall be one continuous cable. All cable shall be as manufactured by Comscope, Belden, or West Penn. Intercommunications system cable shall not share conduit with any other system.

H. Utilize the types of wire recommended by the Sound Equipment Manufacturer. However, the size and quality shall not be less than that previously specified or indicated on the drawings. If cross talk, appreciable loss of volume or distortion occurs after installation has been completed, it shall be the mutual responsibility of the Contractor and Manufacturer to correct any such condition without cost to the owner. The Contractor in no case shall use the type of wire which he merely assumes to be the best. This recommendation shall be from the equipment manufacturer.

I. All remote system low frequency or full range loudspeaker cable shall be 12AWG minimum.

J. The central control console shall be provided with a 10AWG ground wire to earth ground. Conduit ground shall not be acceptable for this purpose.

3.2 DEMONSTRATION

A. Programming: Review all system programming with the owner's representative and the engineer, and obtain written approval before system is put on line. Telephone service interface shall be arranged by the owner.

B. Subsequent to hookups of equipment, test the entire system and demonstrate proper functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

C. Documentation: Bind the test results and cable identification in a cable record book indexed for easy reference during future maintenance operations. Turn book over to the owner's authorized representative upon completion of commissioning.

3.3 TRAINING

A. Upon completion of installation, arrange in service training of the system operation for personnel designated by the owner. Provide a minimum of two, four hour sessions, six months apart.

B. Notify in writing the Architect, Construction Manager, and the Owner of the time and date the first demonstration will take place. Conduct a walking tour of the system.

3.4 TESTING:

A. Subsequent to hookups of equipment, test the entire system and demonstrate proper functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance. Specific Testing requirements for the Sound Reinforcement and Video Systems shall be as follows: Contractor shall provide model and serial numbers of test equipment to be used with the submittals.

B. Definition: The primary audio signal path for the Sound System shall be defined as the output originating at the audio mixer or console main outputs and continuing uninterrupted through processing and amplifiers to, and including, the loudspeaker systems.

C. Performance and Verification Testing of the Sound System shall be performed as specified. Coordinate testing with the Owner. During testing, the room shall be free and clear of any activities that may interfere with the testing procedure. The testing shall be completed in a continuous and timely manner not to exceed two normal workdays. Contractor shall bear any and all costs associated with the conduct, completion, documentation and/or remedies necessary to complete the Performance and Verification Testing procedures.

D. Contractor shall supply test equipment meeting the following minimum specifications.

1. Oscilloscope: 100MHz Bandwidth, Sensitivity 1mV/cm
2. Digital Multi-meter: 1% Accuracy
3. Function Generator: 1MHz Bandwidth, Distortion < 1%
4. Real Time Analyzer: 1/3 Octave, Type I
5. Impedance Meter: 20-20kHz, 1-50kOhm @ 100, 300, 1k, 10k Hz
6. Pink Noise Generator: 20-20k Hz
7. Polarity Meter: Microphone, line, speaker level
8. Millivolt Meter: Analog meter movement
9. SIA Software Smart Live Acoustic Analysis & Real Time Software
10. EASE Acoustic Modeling Software

E. Sound System shall be capable of delivering a sound pressure level (SPL) of no less than 95 dB Direct of program across the entire seating area when measured using a 0 dBV full audio bandwidth signal through the main console output(s) and unity gain structure (0 dBV, nominal) throughout the entire primary audio signal path without audible distortion

or clipping at the input or output of any processing equipment in the primary signal path, amplifiers or the manufacturer's published AES power handling rating (Watts) for the loudspeaker system(s). A minimum of eighteen measurement locations will be required. Submit locations to the owner for approval prior to testing. Results of sound pressure readings shall be plotted on a plan view of the seating area. Note: The owner may choose to attend SPL testing, or have a hired consultant attend or review.

F. Sound System shall be capable of delivering a measures frequency response of ± 3 dB at RASTI frequencies across the entire seating area when measured using a full bandwidth signal not less than 20 dBA above ambient level. The location of measurements shall be the same as those approved for the SPL measurements.

G. Results of frequency response readings shall be plotted on a plan view of the seating area. Note: The owner or his designated representative may choose to attend frequency response testing.

H. Sound System shall be capable of demonstrating a Speech Intelligibility Index of no less than 0.70 at RASTI frequencies throughout the entire seating area with the HVAC system turned off. Speech Intelligibility Index results shall be plotted on a plan view of the seating area. Note: The Architect or his designated representative may choose to attend testing.

I. Sound System shall maintain a Signal-to-Noise (S/N) ratio of better than 80 dB throughout the entire primary audio signal path as measured on an analog millivolt meter.

J. Switching of audio signals in the primary and secondary audio signal path(s) shall be designated and implemented using noiseless switching, i.e., the Fitness Center Sound System shall be free of clicks, pops, snaps, thumps, or any other noise when any system routing or operating control is activated.

K. System outputs of the Sound System shall be swept with a wide band 20 MHz oscilloscope to verify the primary audio signal path is free of any oscillations, radio, crosstalk, or parasitic frequency signals. Record results and provide and install any remedial filtering required for correction with no additional claim for payment.

L. Measure and record the impedance of each pair of speaker lines at permanently mounted loudspeakers with speakers connected and amplifiers disconnected. Record results for each of the system's mid-band frequencies to the nearest one-tenth ohm. Present summary results graphically for each speaker.

M. Receptacles terminated on audio clean power circuits shall be verified to be free of shorts between the Neutral and Isolated Ground (IG) conductors.

N. Audio System Equalizer will be set up using a 6 area Eq. locations and averaged for the final system Eq.

O. Performance and Verification Testing of the Video Presentation System shall be performed as specified. Coordinate testing with the Architect/Engineer and Owner. During testing, the room shall be free and clear of any activities that may interfere with the testing procedure. The Contractor shall supply personnel as necessary to complete the testing in a continuous and timely manner not to exceed one normal workday. The

Contractor shall bear any and all costs associated with the conduct, completion, documentation and/or remedies necessary to complete the Performance and Verification Testing procedures.

P. Contractor shall supply test equipment meeting the following minimum specifications.

1. NTSC/RGB Generator with NTSC Color Bar Pattern, 1Vp-p Composite Video Output, RGB Comp HV outputs on BNC connectors
2. Waveform Monitor (If Necessary)

Q. Video projection system shall be fed with NTSC test patterns of Composite Video and CRGBS formats. The images shall be checked for and corrections made, should any of the following conditions exist:

1. Signal Loss
2. Overpeaking
3. Retrace Problems
4. Pixel Loss
5. Luminance Delay
6. Chrominance Delay
7. Reflection/Ghosting
8. Banding
9. Ground Loop/Hum Bars
10. Blooming
11. Bending

END OF SECTION

SECTION 274133 - TELEVISION DISTRIBUTION SYSTEM

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Television distribution system; complete, ready for operation, including all cables, raceways, terminal backboards, cabinets, pull boxes, outlet boxes, connectors, adapters, splitters, couplers, taps, mounting hardware, amplifiers, equalizers, power supplies, tests, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.

1.2 QUALITY ASSURANCE

A. The television distribution system, including all necessary parts, accessories, connections and equipment shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Underwriters Laboratory (UL) listed and labeled.
4. American National Standards Institute (ANSI)
5. Institute of Electrical and Electronics Engineers (IEEE)
6. Federal Communications Commission (FCC)
7. Local Cable Distribution Company Compliance: Provide products that comply with applicable rules and regulations.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 270500 and General Conditions of Contract:

1. Provide complete submittals, which shall include floor plan drawings indicating outlet locations, schematic wiring drawings, and spec sheets for all equipment. Partial submittals will not be accepted.
2. Spec sheets shall include data on features, ratings, and performance. Components must show compliance with the performance criteria specified herein.

B. If re-submittals are required, they shall be provided within two (2) weeks after the date of notification. If re-submittals are not received by the Engineer in two (2) weeks, the supplier will be considered nonresponsive and subsequent submittals from the supplier will not be reviewed. The Contractor shall then provide submittals from another equipment supplier within two (2) weeks as directed by the owner at no change in contract price.

C. The cost of review of any submittals after two (2) submittals have been rejected shall be paid by the Contractor to the Engineer. Prior to re-submittal, purchase order shall be delivered to the Engineer before additional reviews of submittal start.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 270500 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Recommended renewal parts list
3. Final as-built drawings
4. Complete Wiring diagrams

1.5 RECORD DOCUMENTS

A. The As-Built drawings shall include three (3) complete sets of 30" x 42" contract base sheet drawings with any and all changes included and noted. The As-Built drawings shall be kept up to date continuously by the electrician in charge of the system installation. These drawings shall be reviewed on a weekly basis for accuracy and completeness.

B. The Operation and Maintenance Manual shall include a complete set of equipment, component and device specification and data sheets, and the name and address of the installer. The manual shall be bound in a black three-ring loose leaf binder with dividers and a table of contents. Three (3) duplicate sets are required.

C. All documents and items described above shall be submitted for approval and turnover prior to the final system testing. Three (3) duplicate sets of the Test Report shall be submitted to the Engineer.

1.6 ACCEPTANCE OF SYSTEM

A. Total acceptance of the system will only be made after the required tests, complete record document package, and the instruction period have been provided.

1.7 GUARANTEE

A. The Contractor shall guarantee labor, materials and equipment provided under this contract against system defects for a period of one (1) year after the date of final acceptance of this work by the Owner.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Cabling:
   a) Berk-Tek
   b) West Penn Wire/CDT

c) Belden

d) Commscope

2. Connectivity (Connectors, Adapters, wall plates, etc.):

a) Pass & Seymour

b) Hubbell

c) Leviton

d) Amp/Tyco

3. Passive Components (Splitters, Couplers, Taps, etc.):

a) Blonder Tongue

b) Regal

c) Pico Macom

4. Active Components (Amplifiers, Equalizers, etc.):

a) Blonder Tongue

b) Regal

c) Pico Macom

2.2 SYSTEM DESCRIPTION

A. The intent of these specifications is to provide a complete system that shall receive, amplify, and distribute cable television signals to all TV outlets to permit the connection of standard cable ready television receivers commonly manufactured for the standard frequency bands. The system shall have a usable bandwidth of 5 to 860MHz.

B. The system, as installed, shall be capable of passing standard NTSC color television signals without the introduction of noticeable effects on color fidelity. The system shall provide a minimum signal level of 0 dBMV and a maximum of 10 dBMV, across 75 ohms, per channel at each television outlet. The system and all equipment shall be designed and rated for 24 hours per day continuous operation. The system noise figure shall not be more than 15 dB. The system shall use equipment matched to 75 ohms impedance with maximum voltage standing wave ratio VSWR of 1.4 so as to prevent ghosts or smear. The phasing characteristics of the system shall not cause ghosts of double images to appear in receivers used with the system.

2.3 TELEVISION DISTRIBUTION SYSTEM

A. The Television Distribution System shall conform to the following minimal performance Standards:

1. Provide a maximum of 6 dB tilt between the lowest channel and the highest channel actively distributed in the system.

2. Provide a flush, rack mounted, cable ready, 13-inch color television receiver/monitor to permit line monitoring of all active channels in the system.

3. Provide a minimum of one (1) active administrative distribution channel and one (1) active media distribution channel for each media distribution source and CATV demodulated source supplied in the initial system.

2.4 TELEVISION CABLE

A. Cables shall be 75 ohm, foam FEP dielectric, with quad foil shield. All cables shall be provided with Compression-type 'F' connectors at each cable end.

2.5 TELEVISION OUTLETS

A. Exact location of outlets shall be verified in the field with the Architect/Owner.

B. Refer to specification section 270534 for outlet boxes. Furnish and install a flush two-gang box with single-gang extension ring for each outlet, unless otherwise noted.

C. Provide a minimum ¾" sized EMT conduit from outlet box into accessible ceiling cavity, unless otherwise noted. Where more than two 'F' connectors/service activations are contained within a single outlet, provide minimum 1" EMT conduit.

D. Provide the quantity of 'F' connectors and associated wall plates indicated on the drawings, unless otherwise noted. Verify color selections with the Architect.

E. The basis of design television connector (outlet) is the F-Type QuickPort snap-in series, catalog number KSFF*, manufactured by Pass & Seymour. The connector shall be recessed within the wall plate and provide "screw-on" cable connection front and rear. Verify color selections with Architect/Owner. At each outlet location, provide the quantity of connectors indicated on the drawings, unless otherwise noted.

F. The basis of design for wall plates are Pass & Seymour catalog number AC-1KFP*(1-port) and AC-2KFP*(2-port). Color of wall plates shall match other wiring devices in area, verify color selections with Architect/Owner.

G. Provide blank inserts for unused openings. Provide blank wall plates for outlet boxes having no services activated under this contract and equip empty conduits with nylon pull lines.

H. Verify all color selections with the Architect.

2.6 CABLE TERMINATION LOCATION

A. Each television outlet shall be wired (homerun) to the local telecom room except as otherwise specifically indicated.

B. Extend .500" hardline cable from the main telecom room in the existing Bowman Center to the new Community Center & Adult Daycare building main point of demarcation in Mechanical/ Electrical room #112 and to the new Bowman Center addition demarcation in Utilities #207.

3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install in accordance with requirements of Section 270500 and per manufacturer’s recommendations.
2. Complete installation shall be in accordance with the cable television company's rules and regulations.

B. Wiring:

1. Do not splice coaxial cables between terminating points. Cable between an amplifier and the isolation tapoff unit shall be RG-11 size minimum. Cable for room dropoffs shall be RG-6 size minimum.
2. Each outlet shall be provided with an individual dedicated cable run from the outlet location to the terminal equipment location indicated on Plan or as specified. Allow 1'-0” of slack cable at outlet end and 3' - 0" of slack cable at terminal location.
3. Cable runs of 100’ or less shall be type RG-6 cable. Cable runs greater than 100’ and less than 250’ shall be type RG-11. Cable runs greater than 250’ shall utilize type .500”; if required for proper performance, cable shall be type .750” or larger.
4. All incoming cable and associated accessories located between the site utility terminal location and the building point of demarcation will be furnished and installed by the Local Cable Distributor. Interconnection of incoming cable to the interior building cable shall be by Local Cable Distribution Company at the point of demarcation. This Contractor shall coordinate with Local Cable Distribution Company for location of the incoming cable service.

C. Grounding: Install television system grounding and bonding in accordance with the latest edition of NEC, Article 820, and the requirements contained in specification section 270526.

D. Wiring Methods:

1. The entire installation shall be concealed in the construction except that it may be run exposed in unfinished areas and telecom/electrical rooms. Obtain prior approval from Architect/Owner for exposed portions of installation.
2. Cabling/conduit shall NOT be installed underground without engineer’s approval. All cabling installed below grade shall have a moisture resistant jacket.
3. All cabling installed in return air plenums shall be plenum rated.
4. Above suspended ceilings or in other non-exposed areas, install cables within J-hooks (sized as required). Fasteners shall be placed at random intervals no greater than 60 inches and preferably on 48 inch centers. Cable sag between supports shall not exceed 8 inches.

5. Where wiring enters or travels through walls, floors, etc., or is subject to physical damage, it shall be installed in metallic conduit.

6. Avoid penetration of fire rated walls, ceilings, etc. Where this is not feasible, reseal penetrations (including those in sleeves) with an Underwriter's Laboratories (UL) approved sealant material. Seal all floor, ceiling, and wall penetrations in the wiring closets. For new installations through fire rated walls, provide *Flamestopper* thru wall fitting as manufactured by Wiremold (size as required for each location).

7. Provide minimum 2" sized metallic conduit sleeves above ceilings between non-rated corridors and areas where data outlets are located, and elsewhere where required to install cabling. Provide adequate quantity of sleeves required for all cables.

8. Where an outlet is surface mounted, surface raceway shall be used to cover the cable.

9. The fill shall not exceed 40 percent for cable pathways (raceways, cable trays, j-hooks, sleeves, etc.).

10. Cables and associated hardware shall be placed so as to make efficient use of available space in coordination with other trades and uses. All cables and associated hardware shall be placed so as not to impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).

11. Cables shall be supported in with appropriate cable supports. Cables shall not be fastened to or supported from any other building system (for example: electric conduits, sprinkler lines, ductwork, etc.). Cabling shall not rest on suspended ceilings, be fastened to ceiling support wires, or be installed near steam piping or over light fixtures.

12. Cables shall be routed to avoid light fixtures (18 inches minimum spacing), sources of heat (12 inches minimum spacing), and power cables or conduits (16 inches minimum spacing unless cables are installed in shielded trays or approved conduits). Cables must be spaced a minimum 120 inches (10 feet) from bus duct.

13. Cables must be handled with care during installation so as not to change performance specifications. The Contractor shall not over tighten tie wraps or over bend the cable. Creased or kinked cables will not be accepted and will be replaced at the Contractor's expense.

14. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

E. Backboard Cabling Configuration

1. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, network equipment mounting access hatches to air filters, switches or electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

2. Cable shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Cables shall not be tie-wrapped to electrical conduit or other equipment. Minimum bend radius shall be observed.

3. Lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Lace or tie-clamp all similarly routed cables together, and attach by means of clamps screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via “square” corners over a path that will offer minimum obstruction to future installations of equipment, backboards, or other cables.

F. Labels:

1. The labeling plan shall be developed by the Contractor and approved by Owner/Engineer. The Contractor will label all outlets following the detailed shop drawing design, using permanent/legible typed or machine engraved labels. Terminals in the data closets shall be labeled by the Contractor using designation strips as applicable to terminal hardware. All copper/fiber terminals for riser cables in the data closets shall correspond to terminal numbering in the MDF.

2. The labels on station terminals shall be numerically sequential. Outlets shall be labeled to match the labels on the corresponding terminal position. Patch Panel Labels shall include a room number component and a sequential extension. The room number component shall reflect the numbering system utilized for door labels or room numbers.

3. A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

4. Labels shall correspond to as-built and to final test reports.

5. Labels are to be mechanically generated. Handwritten labels are not acceptable.

3.2 TESTS

A. Each reel of coaxial cable shall be sweep tested for transmission and structural return loss and be so certified in writing by the cable manufacturer. Transmission sweep tests shall establish conformance to guaranteed loss values from 5-750MHz. Structural return loss tests by sweep method shall show a minimum return loss of 26 dB RL VHF.

B. Upon completion of installation, test performance of system and provide written report of test results.

3.3 FIELD ADJUSTMENTS

A. Replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings and sheath removed too far.

B. Perform field adjustments to obtain proper functioning as required to place the equipment in final operating condition in accordance with the contract documents.

C. Necessary field adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the owner.

END OF SECTION

SECTION 275223 – NURSE CALL SYSTEM

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nurse Call system including all necessary installation hardware, wiring, and associated accessories.

1.2 QUALITY ASSURANCE

A. The luminaires, lamps and associated accessories shall be designed, manufactured, installed and tested in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. Underwriters Laboratory (UL) listed and labeled.
3. American National Standards Institute (ANSI)
4. Federal Communications Commission (FCC)

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 270500 and General Conditions of Contract:

1. Nurse Call system data sheets
2. Nurse call system wiring diagram/riser showing specific project requirements.

1.4 SCOPE

A. Furnish and install all equipment, accessories and materials necessary for a complete operating system in accordance with the specifications and applicable drawings. All material and/or equipment necessary for proper operation of the system not specified or described herein shall be deemed part of the specifications.

B. Equipment furnished under this specification shall be the standard product of one manufacturer and shall be equal in performance and quality to that manufactured by TekTone® Sound & Signal Mfg., Inc. of Franklin, NC.

C. All components and the system as a whole shall meet or exceed the minimum standards issued by the EIA. All work in conjunction with this installation shall meet the provisions of the National Electrical Code.

D. The system shall conform to the current NFPA standards and shall be listed as a total system by Underwriters Laboratories, Inc. Listing shall be under NBRZ Hospital Signaling and Nurse Call Equipment, conforming to UL 1069 standard. Proof of such listings shall be made by submitting the UL listing cards describing the equipment by model number, with the bid documents. Alternate manufacturers shall submit the listing cards as part of prior approval, ten days before the bid date.

E. Each major component shall bear the manufacturer's name, catalog number and UL label.

F. Alternate equipment shall be considered only when the following have been submitted and approved in writing by the architect/engineer ten (10) days prior to opening of bid: A list of such alternate equipment and materials, together with three (3) copies of working and shop drawings.

1. The base bid shall be on the Basis of Design equipment as specified.

2. Alternate equipment must be so noted on a separate bid form with an add or deduct amount to the base bid indicated.

G. The contractor shall be responsible for providing a complete functional system including all necessary components, whether included in this specification or not.

H. The contractor shall guarantee availability of local service by factory-trained personnel from an authorized distributor of the equipment manufacturer. The distributor shall have available a stock of the manufacturer's standard parts. On-the-premises maintenance shall be provided, at no cost to the purchaser, for a period of twelve (12) months from date of completion of installation, unless damage or failure is caused by misuse, abuse or accident.

I. On-the-premises demand service at other than normal working hours shall also be available and may be charged for by the manufacturer's distributor at the prevailing labor rates.

2 PRODUCTS

2.1 MANUFACTURERS

A. The products specified shall be new and of the standard manufacture of a single reputable manufacturer. As a reference of standard and quality, functionality and operation.

2.2 WIRING

A. Wiring shall be in strict accordance to the cable specifications found in the manufacturer’s installation manual.

2.3 SYSTEM OPERATION

A. Basic Operation

1. The following sequence of events occur when a resident places a call:

a) When the resident presses the call transmitter button, a signal from the transmitter is sent to the receiver, by way of repeater/locators.

b) The receiver reads the signal and sends information to the master station computer.

c) Tek-CARE®500 software interprets the information, displays it on the monitor, and sounds an event on the master station speakers using a selectable WAV file. A call placed with a fixed transmitter displays its exact location on the monitor, while a call placed with a portable pendant

transmitter displays approximate location, depending upon the number of repeater/locators installed.

d) Staff views the information displayed on the master station computer. Other staff receives event information on pagers, if the Tek-PAGING™ system is also installed.

e) Staff identifies who placed the call and where the call originated, and responds to the call.

f) Staff resets a portable pendant call transmitter by pressing its external reset button. Staff resets a fixed transmitter at the master station computer, using a programmable access password.

B. Master Station Computer Display

1. Once the program has been initiated, its main window is displayed. This shows all the information necessary to monitor the system. There are five areas to the main window:

a) Toolbar and Button Bar—used to select actions.

b) Event Display—lists all events received by the receiver.

c) Registers—display programmed information, including residents information, locations and transmitters.

2.4 EQUIPMENT

A. MASTER STATION COMPUTER

1. The master station computer shall be a Dell or similar PC with the following minimum specifications. It shall display pertinent information about calls processed and shall store this information in a historical record for retrieval later. It shall also control optional devices such as pagers. The master station computer shall be TekTone® NC501ES Master Station Computer.

2. The master station computer shall sound an audible alarm (selectable WAV file) when a call is placed, and staff shall be notified via the monitor of:

a) The resident’s name, room number, and transmitter type.

b) The time the call was received and the time it was reset.

c) Additional information such as resident’s phone number, contact list, or other fields chosen by the facility.

3. Additional information such as resident’s phone number, contact list, or other fields chosen by the facility.

4. The master station computer shall be capable of sending automatic text and email messages in response to wireless emergency call system events, sending customized emails to any email address, and sending customized text messages to pagers and phones.

B. TRANSMITTERS

1. Transmitter batteries must be available from standard retail electronics stores. Transmitters using custom ordered batteries or batteries that cannot be replaced shall not be acceptable.

2. Water-Resistant Single Button Call Transmitter

   a) The water-resistant single button call transmitter shall use the 900 MHz frequency band for signal transmission, shall be water-resistant, utilize a single call button and include a call LED. The transmitter shall be no larger than 2.2" × 1.9" × 0.72". The transmitter shall be lightweight, weighing less than 1.4 ounces, and shall include a neck cord, a belt clip and a 3V lithium battery. Optional wristbands shall be available (RP503, RP504). The transmitter shall be wireless and fully supervised with low battery warning. The water-resistant single button call transmitter shall be TekTone® SF501ES.

3. Water-Resistant Dual Button Call Transmitter

   a) The water-resistant dual button call transmitter shall use the 900 MHz frequency band for signal transmission, shall be water-resistant, utilize two call buttons and include a call LED. The transmitter shall be no larger than 2.2" × 1.9" × 0.72". The transmitter shall be lightweight, weighing less than 1.4 ounces, and shall include a neck cord, a belt clip and a 3V lithium battery. Optional wristbands shall be available (RP503, RP504). The transmitter shall be wireless and fully supervised with low battery warning. The water-resistant dual button call transmitter shall be TekTone® SF501/2ES.

4. Wall-Mounted Call Transmitter

   a) The wall-mounted call transmitter shall use the 900 MHz frequency band for signal transmission, and shall include a single call button and a call LED. The transmitter shall be no larger than 3" × 1.6" × 0.72" and shall include a 3V lithium battery. The wall-mounted call transmitter shall be wireless, fully supervised with low battery warning, and shall be TekTone® SF502ES.

5. Resident Check-In/Assistance Station

   a) The resident check-in/assistance station shall use the 900 MHz frequency band for signal transmission and shall include an LED call assurance indicator. Calls shall be locally latched and require local reset to clear. Check-ins shall be placed by pressing the check-in push button during set check-in times. Power shall be supplied by a 3V lithium battery. The resident check-in/assistance station shall be TekTone® SF529ES

6. Single Resident Bed Station

   a) The single resident bed station shall use the 900 MHz frequency band for signal transmission and shall include an LED call assurance indicator. The station shall provide a ¼" call cord jack and a reset button. Calls shall be locally latched and require local reset to clear. The station shall also detect cord out. Power shall be supplied by a 3V lithium battery. The single resident bed station shall be TekTone® SF530ES.

b) The call cord shall be waterproof and shall be suitable for use in oxygen environments. The call cord shall be TekTone® SF301A pushbutton with 7-foot cord, TekTone® SF301A/10 pushbutton with 10-foot cord, TekTone® SF301A/20 pushbutton with 20-foot cord, or TekTone® SF301G geriatric squeeze-bulb with 6-foot cord.

7. Emergency Switch

a) The emergency switch shall use the 900 MHz frequency band for signal transmission, and shall include an LED call assurance indicator. Calls shall be locally latched and require local reset to clear. Power shall be supplied by a 3V lithium battery. The emergency switch shall be TekTone® SF531ES.

8. Universal Contact Wireless Transmitter

a) The universal contact wireless transmitter shall transmit signals at the 900 MHz frequency band and shall include one selectable NO/NC contact to be used with maintained NO or NC contacts. The maintained NO/NC universal contact wireless transmitter shall be TekTone® SF525ES.

9. Universal Dual Contact Wireless Transmitter

a) The universal dual contact wireless transmitter shall transmit signals at the 900 MHz frequency band and shall include one built-in NC contact and one NO/NC selectable contact to be used with maintained NO or NC contacts. The universal dual contact wireless transmitter shall be TekTone® SF525/2ES.

C. Receiver and Power Supply/PC Interconnect Assembly

1. The receiver shall enable communication between transmitters and the master station computer.

2. The receiver shall use 900 MHz spread-spectrum radio to provide reliability, even in hostile or difficult radio environments. The receiver shall use Echostream technology with diversity reception and advance signal processing to minimize nulls or dead spots.

3. An RS232 serial communications port shall be provided for communication to the master station computer.

4. The receiver shall include slots through the side and bottom of the case for wiring.

5. The receiver shall be TekTone® NC510ES. The power supply/PC interconnect assembly shall be TekTone® PK510.

D. Repeater/Locator, Weatherproof Housing, Backup Battery

1. The repeater/locator shall receive a signal from any wireless transmitter, verify it, and then amplify the signal back to peak power, allowing greater distances between the transmitters and the receiver.

2. The repeater/locator shall provide general transmitter location information using signal strength to distinguish between virgin and retransmitted signals, to ensure that the receiver is sent accurate location information.

3. The repeater/locator shall use wireless radio protocols and Signal Synchronization Technology™ to act intelligently, amplifying transmission from any wireless transmitter while ignoring background noise.

4. The repeater shall include a 14 VAC/20 VA transformer.

5. A NEMA-4 enclosure shall be available to house the repeater/locator either indoors or outdoors. The NEMA-4 enclosure shall be TekTone® IH511.

6. The repeater/locator shall include an integral backup battery.

7. The repeater shall be TekTone® NC511ES.

E. Remote Event Monitor

1. The remote event monitor software shall be available for installation on up to nine computers on the facility's local area network (LAN). It shall monitor system activity as a supplement to the master station computer and shall be able to create management reports using a web browser. The remote event monitor software shall be included with the master station computer.

F. Central Monitoring PC-Alarm Panel

1. The PC-alarm panel shall receive alarm messages from the master station computer via an RS-232 connection and shall then transmit the alarm messages over a POTS line to a central monitoring facility using the Ademco Contact-ID protocol.

2. The PC-alarm panel shall be capable of generating all DTMF signals necessary for message transmission, as well as decoding handshake and kiss-off tones received from the central monitoring station.

3. The PC-alarm panel shall report transmission status to the master station computer over the RS-232 connection.

4. The PC-alarm panel shall be TekTone® NC502.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 270500. Install system to comply with drawings and final shop drawings in compliance with manufacturer's printed instructions.

B. All necessary conduit, raceways, sleeves, fire stopping, pull boxes, and outlet boxes shall be provided by this contractor.

C. The Nurse Call System Supplier shall provide and install complete wiring required by systems herein specified. All wiring shall be tested for continuity and freedom of all grounds and short circuits.

D. Each cable run between the system equipment cabinet shall be one continuous cable.

E. Utilize types of wire recommended by the Equipment Manufacturer. However, the size and quality shall not be less than that previously specified or indicated on the drawings. If cross talk, appreciable loss of signal or distortion occurs after installation has been completed, it shall be the mutual responsibility of the Contractor and Manufacturer to correct any such condition without cost to the owner. The Contractor in no case shall use the type of wire, which he merely assumes to be the best. This recommendation shall be from the equipment manufacturer.

3.2 GUARANTEE

A. The contractor must guarantee, and make available to the purchaser, the service department of a local, duly authorized distributor of the equipment manufacturer which shall stock the manufacturer's standard parts as well as reference information such as technical manuals, etc. The distributor shall supply on-the-premise maintenance during normal working hours at no cost to the purchaser for a period of twelve months from the date of completion of installation.

3.3 TRAINING

A. Upon completion of installation of the nurse call system, arrange a demonstration of the system operation for personnel designated by the owner. Notify in writing through the Electrical Contractor, the Architect, Construction Manager, and the Owner of the time and date the demonstration will take place.

B. The nurse call supplier shall provide instruction to the staff by means of a portable demonstration system, which shall be set up in the conference room or auditorium to give the staff hands-on experience without disrupting normal duties. The demonstration system shall consist of a nurse master station, a dual-jack callcord patient station with associated bath station, code station, staff presence station, dome light, prism dome light, and callcords, a staff station with associated staff presence station, dome light, prism dome light, visual duty station, and special control unit. Special circuitry shall allow placing of typical system diagnostics. The instructor shall demonstrate each function on the system with all dome light/prism dome light displays, screens and audible tones in operation.

C. The supplier's in service trainer (must be a qualified person with teaching certification in Instructional Media or a related teaching discipline) shall perform the system demonstration. This Trainer shall provide all of the in service training assistance specified below. The name and qualifications of the staff trainer shall be provided with the shop drawings for approval.

D. After the initial demonstration, provide a minimum of 40 clock hours of on/off site training of nursing personnel and staff of the hospital during the warranty period as requested by the hospital.

E. The nursing staff of the hospital, as well as maintenance staff, shall be thoroughly instructed for minimum 8 hours in the use of the system by authorized distributor personnel. Such service shall be provided in conjunction with the system equipment.

END OF SECTION

SECTION 280500 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Basic Requirements specifically applicable to all Division 28 – Electronic Safety and Security sections; in addition to the General and Supplementary Conditions of Contract, and Division 01 - General Requirements, applicable conditions of which are hereby incorporated by reference.
2. General Requirements:
   - a) Intent
   - b) Responsibility of Bidders
   - c) Quality Assurance
   - d) Products
   - e) Submittals
   - f) Substitutions
   - g) Guarantees
   - h) Applicable Publications
   - i) Regulatory Requirements
   - j) Project/Site Conditions
   - k) Delivery, Storage and Handling
   - l) Sequence and Scheduling
   - m) Interruption of Services
   - n) Temporary Electrical Service
   - o) Demolition
   - p) Cutting and Patching
   - q) Hazardous Materials
   - r) Operating and Maintenance Manuals
   - s) Record Drawings
   - t) Cleaning
   - u) Painting
   - v) Electrical/Mechanical Sound Control
   - w) Final Acceptance
   - x) Owner Instruction

3. Products:
   a) Vibration Isolators
   b) Pipe Curbs; Equipment Supports; and Flashing
   c) Firestopping
   d) Electrical Identification
   e) Access Panels

B. Related Sections:
   1. General Conditions and Supplementary Conditions of Contract.
   2. All sections of Division 01 – General Requirements (as applicable).
   3. All sections of Division 28 – Electronic Safety and Security.

1.2 INTENT

A. Provide complete and fully operational Electronic Safety and Security systems with facilities and services to meet all of the requirements described herein and in complete accordance with all applicable codes and ordinances.
   1. The term “provide”, as used in these specifications and on the drawings, shall be understood to mean “furnish and install, complete and operational, with all required hardware, accessories and appurtenances.” Unless indicated otherwise, this shall also include all associated power and/or signal wiring required for electrical systems furnished under this Contract.
   2. The manufacturer's recommendations for the particular equipment or system, the National Electrical Code and the Architect/Engineer shall determine what is the complete and proper installation and proper operation.

B. Provide all temporary services and/or equipment as required for all installations.

C. Protect all equipment installed under this contract, until final acceptance of the project.

D. Test all equipment installed under this Contract and adjust the operation of such equipment, leaving all systems in perfect operating condition.

E. Upon completion of the work, thoroughly clean all equipment, leaving the job site and installation in first-class condition.

F. The drawings are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and quality and are not detailed installation instructions.

G. The Contractor will be held responsible for proper installation of materials and equipment to true intent and meaning of both Drawings and Specifications. All items of labor, material and equipment not specified in detail or shown on the drawings, but incidental to or necessary for the complete installation and proper operation of the several branches of work described herein or depicted on the drawings; or reasonably implied in connection therein; shall be provided as if called for in detail by the Drawings and/or Specifications.

H. In cases of discrepancies between drawings, or between the drawings and the specifications, the Engineer will make the final determination as to which is correct. In cases where items appear in the specifications but not on the drawings, or appear on the drawings but not in the specifications they shall be considered as noted on both. Unless written clarification in the form of an addendum is received, the bid shall be interpreted to include the most expensive installation, equipment or work and all associated costs.

I. The Engineer reserves the right of interpretation of the specifications and drawings. The Engineers decisions of interpretations shall be final.

1.3 RESPONSIBILITY OF BIDDERS

A. Examine all contract documents issued. Visit the site and become thoroughly acquainted with the existing conditions prior to submitting a proposal. The submission of a proposal shall be considered as evidence that a site visit was conducted; no extra compensation will be allowed for any error resulting from failure to visit job site. Prior to submitting a proposal, bidders must familiarize themselves with the codes, rules, and regulations in effect at the site of the work, to determine existing conditions that affect their installation.

B. Carefully examine the Architectural; Structural; Heating, Ventilating and Air Conditioning; Plumbing; Fire Protection; Electrical; Technology Systems and/or Miscellaneous Contract Drawings and Specifications. If any discrepancies occur between the drawings or between the drawings and specifications, report such discrepancies to the Architect in writing and obtain written instructions as to the manner in which to proceed. Do not make departures from the Contract Drawings without prior written approval of the Architect.

C. The terms “Security contractor”, “Access Control contractor”, "the contractor" and "this contractor", mentioned in these Division 28 – Electronic Safety and Security specifications and on the drawings, refer to the Contractor responsible for all work and equipment included in the Division 26 - Electrical specifications.

1. Subcontractors: Any reference to, or letting of work contained in these specifications to, any Subcontractor or Manufacturer does not relieve this Contractor of his responsibility for all work, material and equipment in this specification.

D. In all cases where equipment and materials are specified in the singular or plural number, assume that such references shall apply to as many such items as are required to complete the installation.

E. Execute all work, construct and install all equipment in accordance with the current requirements of all Occupational Safety and Health Administration (OSHA), National Fire Protection Association (NFPA), the National Electrical Code (NEC) as amended to date, Underwriters Laboratories (UL), National Electrical Manufacturers Association (NEMA), owner's insurance underwriters and/or other authorities having jurisdiction over premises, public utilities which have connection with any systems specified, and all Federal, State, County and Local ordinances and regulations. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with the aforesaid codes, ordinances, or regulations. Contractor shall be held responsible for accident to persons, material or property caused by failure to adhere to the proper code requirements until the Owner has accepted work.

F. Contractor shall be qualified or licensed to perform the types of work involved under this Division of the Specifications in the state, county and/or municipality of this project as required.

G. Secure and pay for all permits, inspections and approvals required by foregoing authorities in connection with all work specified herein, unless otherwise noted. All costs associated with permits, inspections and approvals shall be included in the contract price unless directed otherwise. Obtain certificates of approval from departments responsible for issuing same. Deliver certificates in triplicate to the Architect/Engineer, at which time they shall become property of the Owner.

H. Wherever any installation, product, equipment item, etc. specified herein is not permitted to be handled or installed, or is otherwise restricted by union regulations, etc., notify the Engineer in writing before submitting a bid, in ample time for modifications in the requirements to be made. If such notification is not given, this Contractor shall be responsible to complete the installation as specified, to the Engineer's satisfaction and at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least three years. See applicable specification sections for any additional requirements.
2. Equipment Service: Products shall be supported by a service organization that maintains a complete inventory of repair parts and is located reasonably close to the site.
3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
5. Nameplates: Nameplates bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
6. Underwriter's Labels: Where applicable, all material and equipment shall bear the label of approval of the Underwriter's Laboratory, Inc.

B. Manufacturer's Recommendations: Install materials in accordance with manufacturer's recommendations. Provide all required hardware, accessories and appurtenances as recommended by the manufacturer to complete the intended installation and function, even though such items may not be specifically called out or detailed on the drawings or in the specifications.

1. The term "manufacturer" as used in these Specifications or on the Drawings shall be understood as applying to a company of established reputation in the

manufacture of the particular equipment, system or apparatus from products of their own make or others; and who assumes full responsibility for products utilized in said outfits, which are not manufactured by them.

C. The Contractor is responsible for the means, methods, techniques, sequences, and procedures of construction and for worker safety.

1.5 PRODUCTS

A. Products, if any, named on the Contract Drawings or documents, and products of manufacturers named first throughout the Project Manual and/or documents, generally constitute the Engineer's Basis of Design, whether or not specifically denoted as such.

B. Products of named manufacturers appearing throughout the Project Manual and/or documents, or on the Contract Drawings or documents, other than the first named manufacturer, are accepted as Equal; however the requirements of the General Conditions regarding equipment shall apply.

C. Where three or more (Acceptable) Manufacturers are named, either in the specifications or on the drawings, contractor shall provide products by one these manufacturers only. Where fewer than three (Acceptable) Manufacturers are listed, and unless specifically indicated otherwise, contractor shall assume the phrase "Or Equal" and may submit standard product of any manufacturer, subject to compliance with these specifications and acceptance or Approval by the Engineer/Architect.

D. If products of manufacturers, other than those named first, differ from those named first in the Project Manual and/or documents, or on the Contract Drawings or documents, to the extent that their proper incorporation into the work requires changes to structural, piping, mechanical, electrical, and/or instrumentation work, or any other changes whatsoever in nature is required; then this Contractor shall be responsible for all such change(s) and all associated cost(s).

E. Thus, if the Contractor provide equipment other than the Engineer's Basis of Design, then the Contractor shall be responsible for all costs, by all trades, as required to accommodate the equipment provided.

1.6 SUBMITTALS

A. General Requirements Applicable to all Division 28 – Electronic Safety and Security sections:

1. Submit under provisions of Division 01 – General Requirements, and in accordance with the following:

a) Within 30 days after signing the contract, submit to the Architect/Engineer a complete list of proposed equipment and materials, giving the name and address of manufacturer and, when required for proper identification, trade names or catalog numbers. Itemize each type of material and each piece of equipment (omitting duplicates).

b) Submit samples of materials for approval at the site as requested by the Engineer. Such materials may be incorporated into the project after approval and serving their purpose as samples.

c) Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal. Produce shop drawings to indicate fabrication details and proposed layouts for shop or field fabrications as named herein.

d) Mark dimensions and values in units to match those specified. Include contract drawing identification, type, quantities, capacities, accessories, rough-in dimensions, manufacturer's name, model number, connection sizes, wiring diagrams, installation instructions, motor horsepower, voltage, phase and amperage, colors, finishes and other pertinent data.

e) Certify, by submittal, that the materials or equipment proposed are satisfactory for the intended application, and that the materials or equipment are in current production with no known plans to cease manufacture.

f) Submittals processed by the Architect/Engineer do not constitute change orders. The purpose of the submittal process is to demonstrate that the Contractor understands the design concept and intent; the Contractor demonstrates this understanding by indicating which equipment and materials he intends to provide and the fabrication and installation methods that he intends to use.

g) If deviations, discrepancies or conflicts between submittals and the contract documents (in the form of design drawings, specifications and addenda) are discovered, either prior to or after submittals are processed by the Architect/ Engineer, the contract documents shall control and shall be followed.

h) Submittals shall bear the Contractor's approval stamp as evidence that he has checked the drawings. Any submittals without this stamp of approval will not be evaluated and will be returned to the Contractor for proper resubmission. Material and equipment reviews by the Architect/Engineer are only for general conformance to the design intent of the project and compliance with information given in the contract documents. Dimensions shall be confirmed and correlated at the job site by the installing Contractor and installation shall be coordinated with other trades. Specifically excluded from shop drawing review are equipment quantities.

i) Coordination composite drawings among the HVAC, Plumbing, Fire Protection, Electrical, Technology, Security and/or Ceiling Contractors are required, with the lead role assigned to the HVAC Contractor. The HVAC Contractor shall prepare ¼" scale drawings with ductwork layout for review by other trades. The other Contractors shall then prepare and provide shop drawings to the HVAC Contractor, who will then prepare final layout and coordination drawings for the project as part of his contract price. The HVAC Contractor shall conduct coordination meetings with all other trades to discuss and resolve interference problems. Once each trade Contractor has initialed the coordination

drawings to indicate approval, the HVAC Contractor shall submit the drawings to the Architect for review. The other trade Contractors should finalize their shop drawings in accordance with the coordination drawings, and submit for Architect's review.

j) The basis of this contract is for a maximum of two (2) reviews of any submittal by the Engineer. If additional reviews of a submittal are required for approval, the Contractor shall compensate the Engineer for additional process charges.

k) Electronic versions of the Electrical drawings may be obtained from the Engineer for a nominal fee.

B. Submittals are the contractor's documents; the Architect's and Engineer's approval constitutes an acknowledgment that the documents have been submitted and nothing more. It is the contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

C. Material and equipment reviews by Architect and/or Engineer are only for general conformance with the design concept of the project and compliance with information given in the Contract Documents. Specifically excluded from the Engineer's shop drawing review are material quantities, connection details, mounting trim, etc.

D. The Contractor is solely responsible for providing materials in conformance with the Contractor Documents. Dimensions shall be confirmed and correlated at the job site by the installing Contractor and installation shall be coordinated with other trades. Shop drawing approval does not modify the Contractor's duty to comply with the Contract Documents.

1.7 SUBSTITUTIONS

A. Refer to Division 01 – General Requirements.

B. Pre-Bid substitutions will not be accepted during the bidding phase. Bids shall be based on the products as indicated on the contract documents and specifications. Any substitutions shall be submitted by the contractor for review and approval by the engineer during the submittal process.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalog number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, assume the phrase "or approved equal", except that the burden is upon the bidder to prove such equality.

D. If the bidder elects to prove such equality, he shall request, in writing, review of the substitution by the Architect/Engineer in accordance with all Supplementary Conditions and/or Division 1 requirements. All such requests shall include manufacturer's literature, specifications, drawings, catalog cuts, performance data or other references or information necessary to completely describe the item.

E. The Contractor shall be responsible for all structural, mechanical, and electrical changes required for their installation, at no additional cost to the Owner.

F. A substitution request constitutes a representation that the Contractor:

1. Has investigated the proposed product and determined that it meets or exceeds the quality level of the originally specified product.
2. Will provide the same or greater warranty than the originally specified product.
3. Will coordinate the installation and make changes to all other work including coordination and compensation to other trades which may be required for the substituted product to be installed with no additional cost to the Owner.
4. Waive claims for additional costs or time extensions, which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

G. Whenever this contractor desires to furnish equipment of a manufacturer other than that specified or intended; the contractor shall include a complete specification of the substituted item along with each submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the contract specifications. Manufacturer's verification specifications shall be written as close as possible over the contract specifications so that an accurate comparison can be made.

H. The verification specification shall include the exact wording of the contract specification and the revised wording, identified properly, indicating all the deviations proposed. If no deviations are noted, the contractor shall furnish the material or equipment in accordance with the contract specifications.

I. Substitutions will be considered when a product becomes unavailable through no fault of the Contractor.

J. Also, when the contractor submits equipment or materials of the manufacturers specified, verification specifications shall be submitted when requested by the Architect or Engineer.

K. In cases where specific manufacturers are listed, the Engineer reserves the right to consider alternate manufacturers. In all cases where equipment and materials are specified as “Basis of Design”, alternate manufacturers who meet the referenced Standards, these specifications and the standard of quality of the basis of design manufacturer may be submitted for consideration in accordance with the following:

1. It is not the intent of these specifications to be biased or proprietary unless a specific list of (three or more) “Approved Manufacturers” is given or an item is specified as “NO SUBSTITUTIONS”, “NO EQUAL”, etc.
2. The Engineer shall make the final determination of the equality of any proposed alternate manufacturers/equipment.

L. The Architect and Engineer reserve the right of final acceptance of all proposed substitutions.

M. Pre-Approval of a manufacturer and/or proposed system/equipment for bidding does not constitute Final shop drawing/submittal approval; nor does it guarantee same. Engineer reserves right to review and approve, comment on, or reject any and all proposed

equipment during required submittal process, after award of contract, regardless of manufacturer being named Acceptable or Pre-Approved.

1.8 GUARANTEES

A. Guarantee all equipment, materials and workmanship and make good any defects in same for a minimum of one (1) year following date of acceptance of the project. Provide additional/special warranties where called for in the technical specifications.

1. Defects determined to be the result of misuse of apparatus by the Owner, his employees, tenants or building occupants shall not be covered by this warranty.

B. Warranty shall be in writing and shall include written copies of factory warranties with expiration dates on items of equipment where warranty date might differ from the acceptance date. No warranty shall start before date of acceptance in writing by the Architect. Repair or replace any defective work developing during this period, at no cost to Owner. Where defective electrical work results in damage to work of other contracts, this contractor shall be responsible to repair and/or restore such work to its original condition, again at no additional cost to Owner.

C. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives, as well as misrepresentations of such data. If the products have been installed in accordance with the manufacturer's published or written instructions and recommendations, and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and all associated work and materials, at no cost to the Owner.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents or applicable codes establish stricter standards.

C. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.

D. National Fire Protection Association (NFPA)

E. International Code Council (ICC)

F. National Electrical Manufacturers Association (NEMA)

G. Underwriters Laboratory (UL)

H. Institute of Electrical and Electronics Engineers (IEEE)

I. American National Standards Institute (ANSI)

J. ADA Accessibility Guidelines for Buildings and Facilities (ADAAG)

1.10 REGULATORY REQUIREMENTS

A. Conform to the latest requirements of the National Electrical Code and the International Code Council Electrical Code. In addition, all applicable Federal, State, Municipal or other authority laws, rules and regulations shall apply.

B. Secure and pay for any and all permits and inspections required by any of the foregoing authorities having jurisdiction, and pay all other costs in connection with the work, unless otherwise noted.

C. Comply with the latest requirements for the protection from fire and panic of the Department of Labor and Industry of the Commonwealth of Pennsylvania/the Pennsylvania Uniform Construction Codes.

D. Underwriters' Laboratories (UL) listings and National Electrical Manufacturer's Association's (NEMA) stamps or seals shall be evidenced where applicable to electrical apparatus.

E. Conform to applicable regulations of Department of Environmental Protection, Department of Labor and Industry, and OSHA. Comply with applicable safety related work practices described in NFPA-70E.

F. Secure rough-in and final wiring certificates from the Middle Department Inspection Association or other independent inspection agency acceptable to the Engineer. Provide certificates in triplicate and deliver to the Architect prior to project close out.

G. Updated Standards: At the request of the Architect/Engineer, submit a change order proposal where an applicable industry code or standard has been revised and reissued after the date of contract documents and before performance of the work affected. The Architect/Engineer will decide whether to issue a change order to proceed with the updated standard.

1.11 PROJECT/SITE CONDITIONS

A. Refer to Division 01 - General Requirements.

B. Install work in locations shown on the drawings, unless prevented by project conditions.

C. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of the Architect and/or Engineer before proceeding.

D. Perform all minor cutting and patching, and make all changes, relocations and installations with a minimum of noise. All present and new equipment, floors, walls, etc., shall be adequately protected from dust and dirt caused by the work. Protection shall include suitable temporary barriers or coverings. Maintain exterior and interior premises of the building as clean as possible during construction. At no time shall the Contractor interfere with the normal operation of the building by allowing debris, excess earth, etc., to remain on the premises.

E. Dust Prevention: Due to critical dust prevention requirements, obtain approval from the Owner's representative on the site before starting any cutting of the present building. Approval shall be obtained for each location prior to cutting. Provide any temporary work including materials required to retain the dust generated by this work. Provide temporary dust containment barriers, curtains, etc. as directed by the Architect/Owner and remove some when no longer needed.

F. Generally, inspection and maintenance should only be performed on equipment to which power has been turned off, disconnected and electrically isolated so that no accidental contact can be made with energized parts. Follow all manufacturer's warnings and instructions.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 01 - General Requirements.

B. Deliver materials and equipment to the project site in a clean condition with openings plugged or capped (or otherwise sealed by packaging) both during shipping and during temporary storage. Deliveries shall be scheduled to minimize the amount of time in temporary storage.

C. Delivered equipment crating and/or packaging shall clearly identify pick points or lifting points. In the absence of crating or packaging, pick points or lifting points must be identified on the equipment.

D. When unloading materials and equipment provide special lifting harness or apparatus as may be required by manufacturers. Handle materials and equipment in accordance with manufacturer's written instructions.

E. Determine the required equipment needed for unloading operations and have such equipment on site to perform unloading work on the date of equipment delivery.

F. Store materials on site only where directed by the Owner. Materials and equipment, both on site and off site, shall be stored in accordance with manufacturer's written instructions. Store all materials in dry locations, off ground and keep moisture free at all times.

G. Throughout construction, Contractor shall protect, at his own expense, all work, materials, and equipment furnished and/or installed under this Division. Units and devices both before and after being set in place, shall be securely protected from carelessly or maliciously dropped tools, materials, grit, dirt or any foreign matter. Contractor shall be held responsible for damage so done until work is fully and finally accepted.

H. The Contractor shall be entirely responsible for all apparatus, equipment and appurtenances furnished by him or his subcontractors in connection with the work, taking special care to protect all parts thereof in such manner as may be necessary or as may be directed.

1. Protection shall include covers, crating, sheds or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment.

I. Materials and equipment shall be stored in areas designated by the Owner and/or the General Contractor. Where equipment must be stored outside the building, it shall be totally covered and secured with heavy, waterproof tarps and kept dry at all times. Where equipment has been subjected to moisture, it shall be suitably dried out before being placed in service.

J. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products and equipment to assure that they are being maintained under specified conditions, and free from damage or deterioration.

1.13 SEQUENCING AND SCHEDULING

A. Refer to Division 01 - General Requirements.

B. Interference:

1. The drawings are generally diagrammatic and indicative of the work. The Contractor is responsible for modifying the work with offsets, bends, or other fittings to avoid minor interference's and structural obstructions. Perform such modifications at no increase in cost to the Owner.

2. Construct Electronic Safety and Security systems in a manner not to delay or interfere with other operations of work in the project.

3. Prior to installation, coordinate Electronic Safety and Security work locations with other operations of work, especially in congested areas such as mechanical rooms and above hung ceilings (if applicable).

4. In the event that interferences develop, the Architect/Engineer’s decision shall be final and no additional compensation will be allowed for relocation of work/equipment of this Division - regardless of which work or equipment was installed first.

C. Contract Interface:

1. Work performed in cooperation with other contracts: The responsibility for performing work of this contract in cooperation with work of other contracts rests solely with this Contractor.

a) Prior to rough-in, coordinate exact requirements and characteristics for all equipment with contractor furnishing same.

1.14 INTERRUPTION OF SERVICES

A. Refer to Division 01 - General Requirements.

B. At the beginning of the project, review Owner’s procedures relating to utility interruptions and plan the work of this Division accordingly. Develop a preliminary utility interruption schedule and submit to the Owner for approval before developing final project schedules.

C. Schedule the work to avoid major interruptions of any systems or services. Interruptions shall be done during overtime or weekend hours, if necessary, at no additional cost to the Owner.

D. Notify Owner's representative a minimum of five (5) working days prior to any interruption of services.

1.15 TEMPORARY ELECTRICAL SYSTEMS

A. Refer to Division 01 - General Requirements.

B. Do not use permanent electrical systems for temporary purposes without prior written permission from the Owner.

C. The use of permanent electrical systems for temporary purposes shall not modify the terms of warranty.

1.3 DEMOLITION

A. The intent is to demolish all work as shown on the drawings and as required for new installations. The drawings are diagrammatic in nature and are intended to represent only the general scope of demolition; neither the demolition drawings or notes shall be considered as all inclusive. The contractor shall review the existing facility, along with the demolition drawings, and shall be responsible to determine the exact extent of the electrical demolition work required to fulfil the intent of the contract documents.

B. This contractor shall disconnect and remove any electrical circuits (120V and above), connections (and associated wiring or conduit) from other trades work that involves electrical connections. Contractor shall reference other trades drawings and determine the exact extent of demolition work required.

C. Perform all demolition work with care and protect portions of the existing installation that are to remain from damage. Damage to existing building equipment, systems, finishes, etc. so incurred shall be repaired by this contractor at no additional cost.

D. Restore damaged or defaced work remaining in place to its original condition.

E. Existing equipment and materials, removal of which is not indicated by the contract documents or required to accomplish the project intent, shall remain unless noted otherwise.

F. Refer to the new work drawings for additional information which may affect demolition work, prior to beginning demolition.

Disconnect and remove any ceiling mounted devices that interfere with removal of existing ceiling; store for reinstallation. Retain all associated wring and conduit for reinstallation.

1.4 CUTTING AND PATCHING

A. Refer to Division 01 - General Requirements; Division 07 – Thermal and Moisture Protection; and Division 09 - Finishes.

B. Perform all cutting and patching required for the installation of work under this Division unless noted otherwise. Refer to appropriate sections of Division 09.

C. Perform finishing and roof flashing in areas of existing building or roof not being disturbed under general construction, for installation of work under this Division. Refer to appropriate sections of Division 07.

1. Where openings are to be made in existing roof, obtain bonding company approval, if roof bond is still in effect, before such openings are made.

D. Obtain approval from Owner's representative before cutting of any existing work or building construction.

E. All existing surfaces shall be repaired and finished to match existing adjacent surfaces.

F. All openings must be neatly drilled, bored or cut in a workmanlike manner, with materials and equipment suitable for the purpose. Punching or chipping of concrete will not be permitted. All openings shall be drilled, bored or cut in a manner satisfactory to and at locations approved by the Architect.

G. Materials damaged under this contract shall be patched or replaced as directed by the Architect.

1.5 HAZARDOUS MATERIALS

A. Refer to appropriate sections of Division 02 – Existing Conditions.

B. Should hazardous or toxic materials be encountered in any existing work, notify the Owner immediately. Do not disturb surfaces or equipment containing hazardous materials without written authorization of the Owner/Architect. All such materials, equipment or components removed by this contractor shall be properly disposed of in accordance with applicable rules and regulations.

C. No known hazardous or toxic materials shall be incorporated into the final construction or any equipment provided under this Contract.

D. Hazardous or toxic materials utilized as a construction aid shall not be stored within the building and shall be removed promptly from the job site when no longer required.

1.6 OPERATING AND MAINTENANCE MANUALS

A. Submit under provisions of Division 01 – General Requirements, and in accordance with the following:

B. Provide heavy-duty catalogue binders with appropriate labeling.

C. Binders shall be indexed by material and/or system type and at a minimum shall include:

1. Title page with clear plastic protection cover.
2. List of Drawings.
3. Description of Systems: Provide complete and detailed description of systems.
4. Operating Division: Provide complete and detailed operation of major components.

5. Maintenance Division: Provide preventative maintenance schedule for major components.

6. List of Equipment Suppliers and Contractors: Provide list of equipment suppliers and contractors, including address and telephone number.

7. Certification: Include copy of tests performed on insulation, grounding, continuity, phase balancing and signal systems; electrical equipment tag identification and wiring color code; inspection approval certificates for electrical systems and operational tests on applicable electrical equipment.

8. Shop Drawings and Maintenance Bulletins: Provide materials received in compliance with clause 'Shop Drawings', arrange alphabetically.

D. Divider Tabs: Laminated Mylar plastic and colored according to Section.

E. Submit documents for approval prior to being turned over to the Owner.

1.7 RECORD DRAWINGS

A. Submit under provisions of Division 01 – General Requirements, and in accordance with the following:

B. Keep on site at all times an extra set of drawings and specifications recording changes and deviations from contract documents including all addendum, bulletin and request for information data. Documents shall be updated on a daily basis. This set of documents shall be used specifically for this purpose.

C. The record drawings shall accurately reflect the as-built conditions at the time of the project completion.

D. Record drawings shall be presented with maintenance manuals to the Architect for approval at the time of final acceptance of the project, prior to being turned over to the Owner.

1.8 CLEANING

A. Refer to Division 01 - General Requirements.

B. Prior to the date set for final inspection and at the direction of the Architect, all new Electronic Safety and Security system(s) components, cabinets, devices, and equipment in general, shall be cleaned as required to remove plaster, dust, paint splashes, labels, etc. from the equipment and fixtures.

C. Any damage in system(s) or other damage to any part of the building, its finish or furnishings, due to failure to properly clean electrical equipment and or associated components, shall be repaired by this Contractor at no additional cost to the Owner.

1.9 PAINTING

A. Refer to Division 01 - General Requirements; and Division 09 – Finishes.

B. Prepare for painting of exterior surfaces of unfinished materials, equipment, ironwork, etc. exposed in finished areas by cleaning surface of foreign matter, grease, dirt, and dust.

C. Paint exposed items or equipment, and all structural steel or miscellaneous metal, installed under this portion of the specifications.

D. Refer to Painting section(s) of the specifications under Division 09. Surfaces shall be primed and finish painted. Each coat shall be a different shade, with final coat of the color as selected by the Architect.

E. Paint on factory finished equipment chipped or scrapped during installation shall be touched up. Touch up paint to be supplied by equipment manufacturer.

1.10 SPECIAL EQUIPMENT CONDITIONS

A. Engineering drawings are, of necessity, schematics for special equipment as exact roughing-in and requirements may vary with different manufacturers. Each trade shall connect its respective services to all special equipment indicated on the drawings at no additional cost to the Owner.

B. In general, duct detectors required for heating and ventilating equipment over 2000 cfm, such as roof top units, water source heat pumps, energy recovery units, etc., shall be furnished by the Electrical Contractor and delivered to the HVAC Contractor for installation; Fire alarm wiring/final connection by Electrical Contractor

1. Electrical Contractor shall coordinate with the HVAC drawings for duct detector locations and quantities.

a) Units with a cfm of 2000 or greater shall have a duct detector in the supply.

b) Units with a cfm of 15,000 or greater shall have duct detector in the supply and return.

c) ERV’s with exhaust ductwork with a cfm of 2000 or greater shall have a duct detector in the exhaust ductwork in addition to the requirements above.

1.11 ELECTRICAL/MECHANICAL SOUND CONTROL

A. All equipment shall operate without objectionable noise or vibration within Noise Criteria Curves listed in Sound Control Fundamentals of the latest edition of the ASHRAE Handbook of Fundamentals. Sound and vibration measurements shall conform to the ASHRAE Handbook of Fundamentals. If such objectionable noise or vibration shall be produced and transmitted to occupied portions of the building by electrical/mechanical equipment (i.e. generators, transformers, etc.) or other parts of this work, any necessary changes, as approved shall be made without additional cost to the Owner. Noise levels shall conform to the requirements of OSHA.

B. Any and all other insulation or isolation required to accomplish results specified above shall be furnished and installed without additional cost to the Owner.

C. Isolation systems shall be installed in strict accordance with the manufacturer's written instructions and submittal data. Locations of all vibration isolation products shall be selected for ease of inspection and adjustment, as well as for proper operation.

D. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.

1.12 FINAL ACCEPTANCE

A. Refer to Division 01 - General Requirements.

B. When the installation is reported in writing by the contractor to be complete and ready for acceptance, an inspection shall be made by the Contractor and in the presence of the Engineer to ascertain whether it complies with the contract documents. If in the opinion of the Engineer it fails to do so, the Contractor shall at once remedy all defects and shortcomings.

C. Any additional tests that may be required shall be entirely at the Contractor's expense.

D. All testing work shall be done when and as directed by the Engineer.

1.13 OWNER INSTRUCTION

A. Refer to Division 01 - General Requirements.

B. Furnish the services of qualified personnel, approved by the Engineer and thoroughly familiar with the completed installation, to instruct the Owner's permanent operating personnel in the proper operation of all systems included under this contract and the proper care of all equipment and apparatus. Unless required otherwise in the technical sections of this specifications, these services shall be furnished for a period of one (1) 8-hour day, after the operation of the systems has been taken over by the Owner.

C. When instructions are provided under this contract, the Contractor shall have in his possession three (3) copies of an identifying letter which shall list the names of the Contractor's qualified instruction personnel, including manufacturers' representatives and subcontractors that will be giving the instructions. Likewise, on this same letter, spaces shall be provided for the Owner's personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor's representatives and subcontractors shall sign and date the letter, and the Owner's personnel shall sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One signed copy shall be delivered to the Owner, one copy to the Engineer and one copy shall be retained by the Contractor.

D. In addition to the instructions outlined above, the Contractor and his manufacturers' representatives and subcontractors shall furnish written basic instructions indicating the proper operation of each system and associated equipment. Each manufacturer shall also submit a brochure on his equipment, including instructions on operation, recommended spare parts, and instructions on preventative, routine and breakdown maintenance.

E. Combine the written instructions and the manufacturers' equipment brochures in complete volumes with hardback binders which shall be turned over to the Owner before final acceptance of the contract work. The Contractor shall obtain two (2) copies of a signed receipt from the Owner for the written instructions and equipment brochures. One copy of the receipt shall be delivered to the Engineer and one copy retained by the Contractor.

2 PRODUCTS

2.1 VIBRATION ISOLATORS

A. Neoprene Isolation Pads:

1. Neoprene isolation pads shall be single rib or crossed, double rib neoprene in shear pads, in combination with steel shims when required, having minimum static deflections as tabulated. All neoprene pads shall be true neoprene in-shear using alternately higher and lower ribs to provide effective vibration isolation, and shall be molded using 2500 psi tensile strength, oil resistant, compounds with no color additives. Pads shall be 45 or 65 durometer and designed to permit 60 to 120 psi loading, respectively, at maximum rated deflections. Neoprene in-shear isolation pads shall be provided to meet tabulated minimum operating static deflections without exceeding published maximum static deflections. Use single or, crossed, double rib or laminated composites of both as required. When two pads of ribbed material are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate.

2.2 PIPE CURBS, EQUIPMENT SUPPORTS, AND FLASHING

A. Prefabricated curbs and supports:

1. Roof Pipe Curbs: Minimum 18 gauge galvanized steel construction with continuously welded corner seams, factory installed wood nailer and 1-1/2”, 3 pound density rigid fiberglass insulation, acrylic coated ABS plastic cover with required number of openings for piping and conduit, and graduated step neoprene boots with stainless steel clamping bands. Style shall be coordinated with roof construction. Minimum height shall be 12” above finished roof surface.

2. Roof Equipment Supports: Minimum 18 gauge galvanized steel construction with continuously welded corner seams, factory installed 2x4 wood nailer and 18 gauge galvanized steel counter-flashing and screws. Style shall be coordinated with roof construction. Minimum height shall be 12” above finished roof surface.

B. Pipe Boots: Minimum .060” thick EPDM, neoprene, or Hypalon, ozone and ultraviolet resistant, minimum service temperature range of -60°F to 270°F, 3’ base flange, conical shaped steps with double thick molded ribs for each pipe size, stainless steel clamps.

C. Sheet copper flashing: Conform to ASTM B 152, weight not less then 8 ounces per square foot.

D. Sheet lead flashing: Weight not less then 3 pounds per square foot for field constructed flashings and not less than 2-1/2 pounds per square foot for prefabricated flashings.

2.3 FIRESTOPPING

A. Refer to appropriate sections of Division 07 for additional information and requirements.

B. Compliance

1. In accordance with IBC requirements and Authority Having Jurisdiction.
2. ASTM: E84-96 and E814-94
3. Factory Mutual Engineering and Research Corporation (FM)
4. Underwriters Laboratories, Inc. (UL): 1479
5. Warnock Hersey (WH)

C. Materials

1. Use either factory built firestop devices or field erected through-penetration firestop systems to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
2. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 4 in nominal pipe or 16 sq. in. in overall cross sectional area.
3. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.
4. Firestop sealants used for firestopping or smoke sealing shall have following properties:
   a) Contain no flammable or toxic solvents.
   b) Have no dangerous or flammable outgassing during the drying or curing of products.
   c) Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
   d) When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
5. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
   a) Classified for use with the particular type of penetrating material used.
   b) Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
   c) Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.

6. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.

7. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

8. Materials shall be asbestos free.

2.4 IDENTIFICATION LABELS FOR EQUIPMENT

A. Identification labels (Nameplates) for equipment shall be standardized for the project at 1/16” thickness, by 3” in length, by 1” in height, having engraved white letters 1/4" height on a black background.

1. Exceptions shall be made to increase size (as approved by the engineer) for field requirements or other needs requiring a different length, etc. to satisfy conditions.

B. Labels shall be manufactured of engraved Phenolic Plastic, Micarta or Bakelite with pressure-sensitive adhesive backing, and shall be colorfast. Flexible plastic punched tapes are not be acceptable. Nameplates shall be electrically non-conductive with beveled edges Adhesive backing shall be chemically compounded to hold tight and fast at wide temperature extremes and environments. Equipment or item to receive the adhesive backed label shall be cleaned per label makers recommendations prior to application. Additionally, all labels shall be secured with screws or rivets. Coordinate labels with those being supplied under other contracts.

C. Nameplates shall conform to Military Standard LP 387A Type N.D.P. LP 509

D. Labels shall be as manufactured by Seton NamePlate Company, Bunting Company, Brimar Industries, or approved equal.

2.5 ACCESS PANELS

A. Furnish factory-fabricated access panels for access to all concealed pull boxes, junction boxes, capped conduits and other electrical equipment where no other means of access is available. Access panels for electrical work, along with all required auxiliary or supporting steel, hardware, etc, shall be furnished by the electrical contractor to the general contractor, who shall install them. Access panels are not required at lift-out removable tile ceilings.

B. Access panels shall be of appropriate size but not less than 18" x 12". Panels shall be flush type, hinged to drop down and out, screwdriver operated, stainless steel in masonry and tile work and prime-coated sheet steel in plaster or acoustical tile of all types.

C. At locations where access panels are installed in fire-rated ceilings, access panels shall contain the 1-1/2" hour fire-rated "B" label, and, in addition, shall also be provided with layers of gypsum wallboard in a thickness which will supply an additional one-hour fire rating. Coordinate rated ceiling requirements with the Architectural drawings.

D. Determine the exact locations and sizes of required access panels and coordinate same with the Architect. Access panels shall not be installed without prior approval of the

Architect. All panels shall be installed and located to present a neat and symmetrical appearance.

E. Junction boxes, capped conduits and other electrical equipment above removable tile ceilings or above panels shall be suitably identified by small, inconspicuous adhesive-backed labels attached to the ceiling surface or the surface of the access panel. Labels shall be white with 3/8" high black letter and shall be a manufactured item for that purpose.

3 EXECUTION

3.1 GENERAL INSTALLATION

A. All work shall be installed in a neat and workmanlike manner by craftsmen experienced in the trade involved and shall be acceptable to the Engineer. All details of installation shall be mechanically and electrically correct. All materials and equipment shall be new, and without imperfections or blemishes, unless otherwise noted.

1. Only qualified personnel familiar with proper voltage equipment shall perform work covered by this Division of the Specifications.

B. Before ordering any material or doing any work, the Contractor shall verify all measurements at the site and shall be responsible for the correctness of same. No compensation will be allowed on account of difference between actual dimensions and measurements and those indicated on the drawings. Any difference, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

C. This specification includes under each item all labor, material and equipment necessary to properly install complete, adjust, and place in operating condition, satisfactory to the Engineer, the several branches of work described herein. This shall include all necessary interconnections between the several branches of work described herein, and connections to work under other sections of specifications and other contractors.

D. All items of labor, material or equipment not described in detail by specifications or drawings, but which are incidental to or necessary for complete installation and proper operation of several branches of work described herein, or reasonably implied in connection therewith, shall be furnished and/or installed as if called for in detail by drawings or specifications.

E. Follow all safety requirements as required by Code, including but not limited to those listed below:

1. Printed instructions shipped with the equipment.
2. Code-required and/or industry-accepted practices.
3. Electrical safety guidelines and practices.

F. The drawings are generally indicative of the work required and shall be followed as closely as circumstances will permit, however they do not indicate all bends, fittings, boxes and accessories which may be required. The Contractor shall carefully investigate structural and finish conditions affecting work and arrange work accordingly, furnishing such fittings, accessories, etc., required to meet such conditions. Contractor will be held responsible for

proper installation of materials and equipment to the true intent and meaning of contract documents.

G. Carefully examine all contract documents, including those of all other trades; layout, plan and execute electrical work so as not to delay or interfere with the work of other trades. Obtain in writing from contractors of other trades such data as is necessary for proper coordination of the work.

H. Lay out work from dimensions of architectural and structural drawings and actual dimensions taken at the site; and from the approved dimensions of equipment being installed. Layouts in general shall not be scaled from electrical and/or mechanical drawings, but in congested areas in particular. No extra compensation will be allowed on account of difference between actual dimensions and measurements and those indicated on the drawings. Any difference, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

I. Coordinate locations of conduit, wiring, outlets, devices, equipment, etc. to be clear of windows, doors, openings, diffusers, return grilles, sprinklers and other services and utilities. This Contractor shall be held responsible to coordinate his work with that of all other trades so that all work may proceed in an orderly manner and conflicts and delays may be avoided. Where drawings indicate special space allocation for different contracts, contractors shall rigidly adhere to the sequence of installation designated by the Engineer or required to allow all trades to work their equipment or materials into place and in respective order. Special attention shall be paid to work under the floor slabs, above ceilings and in locations otherwise concealed. All work shall be thoroughly tested before being closed in.

J. Secure dimensions of all outlets and devices; and other Electronic Safety and Security equipment in general, immediately upon the award of the Contract. Work closely with the General, HVAC, Plumbing, Electrical and/or other Contractors and provide to them the necessary information and dimensions so that there will be no interference between piping, duct work, structural steel, furring channels, etc. and Electronic Safety and Security systems, equipment and wiring.

K. Where outlets in ceiling construction occur in beams instead of in center, move outlets to center. Architect's final approval, however, is required prior to any such relocation. In case interference or fouling results, the Architect shall decide which is to be relocated, regardless of which is first installed.

L. Where required and as necessary, firmly support and secure all materials and equipment installed under this Contract to the building construction.

M. Determine the location and size of chase(s) and opening(s) necessary for proper installation of electrical work, sufficiently in advance and have same provided during erection of the work in which the chases and openings are required. This contractor shall furnish and set sleeves, hangers, and anchors, and shall be responsible for their proper and permanent location.

N. In cases where cutting of new building construction is necessary due to failure of this contractor to set proper sleeves or inserts, or to properly coordinate openings and chases required in said construction, such cutting shall be done and repaired to match the original condition of the work by this contractor and for no additional compensation.

O. Points of connection and termination of work under this specification are shown or noted on the drawings and/or stated within the specification; in case of doubt as to such points, the Engineer's decision shall be final.

P. Equipment, conduit, wiring, devices and other Electronic Safety and Security work shall be installed so as to preserve access to items that are intended to be accessible (i.e. cabinet doors, valves, filters, accessories, etc.), both those furnished under this specification and those furnished under other specifications. Clearances shall be provided on all sides of equipment as required for proper maintenance purposes, recommended by the equipment manufacturer, required by the National Electrical Code or required by other applicable codes.

Q. Follow manufacturer's published recommendations for installation methods not otherwise specified.

R. Furnish the services of manufacturer's representatives for each piece of major equipment furnished under these contract documents. The amount of factory service provided by the contractor shall be as normally recommended and furnished by the various equipment manufacturers unless specified otherwise.

S. Testing of equipment shall be made under the direct supervision of competent authorized service representatives. Any and all expenses incurred by equipment manufacturers' representatives shall be borne by the contractor.

T. Seal all openings left in building construction by the installation of work specified under this section. Sealing shall be performed in accordance with "Cutting and Patching" section specified herein and as directed by the Architect.

U. Where the vapor barrier of any insulation is broken due to the installation of conduit and equipment, properly repair all insulation and seal all openings with vapor barrier covering and vapor barrier adhesive of type installed with the insulation.

V. Upon completion of the work, all remaining waste materials and rubbish resulting from the contract work shall be removed from the building and premises.

W. Should job conditions or specified requirements conflict with manufacturer's instructions, consult the Engineer for clarification. Do not proceed with work without clear instructions.

X. The Contractor and his subcontractors shall satisfactorily complete the systems so that they are functional and operating to the satisfaction of the Engineer. All systems, their controls and their sequencing must be demonstrated to the satisfaction of the Engineer.

Y. Field Adjustments: Adjust relay and protective device settings according to recommended settings provided by the coordination study. Notify owner in writing of any major equipment modifications which may be required prior to proceeding.

3.2 RELOCATION OF EXISTING WORK

A. Where existing equipment, wiring, cables, outlets, etc. are indicated as being relocated and a connection is not shown or noted, this Contractor shall extend and reconnect the existing circuit as required.

B. In areas where the general construction work interrupts the continuity of wiring to existing Electronic Safety and Security equipment and/or devices, this Contractor shall relocate and/or replace that portion of the wiring as required – whether such work is specifically indicated on the drawings or not.

3.3 EQUIPMENT CONNECTIONS

A. The drawings show generally the location of electric service to each piece of equipment. However, this contractor shall secure detailed shop drawings showing dimensioned locations for service to each piece of equipment from various contractors supplying such equipment prior to roughing-in.

B. This contractor will be required to relocate any misplaced outlet at his own expense if he fails to secure detailed shop drawings prior to roughing-in for equipment.

3.4 PIPE CURBS; EQUIPMENT SUPPORTS; AND FLASHING

A. Coordinate installation of curbs, equipment supports, and flashing with the roofing work. Refer to Architectural drawings for related details.

B. Minimum curb and support height shall be 12 inches.

C. Flash and counter flash where electrical conduit and equipment passes through weather or waterproofed walls, floors and roofs.

3.5 FIRESTOPPING

A. Install sleeves and firestopping at all openings in fire and smoke rated barriers around wiring and equipment installed under this contract to maintain the rating of the barrier.

B. Firestopping materials shall maintain the fire rating of the barrier in accordance with the requirements of NFPA, the local governing bodies and other applicable codes.

C. Refer to the Architectural drawings for locations and ratings of all fire and smoke rated barriers.

3.6 IDENTIFICATION OF EQUIPMENT

A. Coordinate identification systems with Owner’s existing systems or master systems before ordering material.

B. Clean all surfaces in accordance with manufacturer's recommendations before installing identification. Identification shall not be installed before final painting is complete.

C. Nameplates:

1. Install interior nameplates with permanent adhesive, screws, bolts or rivets.
2. Install exterior nameplates with screws, bolts or rivets.
3. Identify components such as switchboards, panelboards, safety switches, junction boxes, breakers, terminal cabinets, etc.

4. Equipment shall be identified by title as taken from the plans in a position that is clearly visible. Nameplate nomenclature shall be verified with building owner and Engineer prior to installation.

5. Identify the location of equipment concealed above a ceiling with a color-coded thumbtack in ceiling.

3.7 MOUNTING HEIGHTS

A. In addition to careful review of the electrical drawings, this Contractor shall refer to all applicable details, plans, etc. of the architectural drawings for exact positioning of electrical, telephone, data, television, video, etc. outlets prior to installations. Unless otherwise specifically instructed, centerline-mounting heights of outlets and other equipment shall be located as follows:

1. Fire Alarm Pull Stations: 44" above finished floor.

2. Fire Alarm Audio/Visual and Visual Only Devices: 80" above finished floor, measured to the bottom of the back box. Where low ceilings prohibit compliance with the aforementioned height, devices shall be mounted within 6" of the ceiling per NFPA 72.

3. Blank Outlets: Coordinate location with served equipment manufacturers shop drawing and installation details for service connection point of access except as otherwise noted.

B. Where exact location, mounting height or orientation for a device, fixture, outlet or other electrical equipment may be unclear, request clarification from the Architect prior to rough in or installation.

END OF SECTION

SECTION 280526 – GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. General grounding and bonding requirements of Electronic Safety and Security systems installations for personnel safety and to provide a low impedance common ground reference plane.

1.2 QUALITY ASSURANCE

A. Grounding and bonding equipment, including all necessary accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Institute of Electrical and Electronics Engineers (IEEE)
4. Underwriters Laboratory (UL) listed and labeled.
5. American National Standards Institute/Telecommunications Industry Association/Electronics Industries Alliance (ANSI/TIA/EIA)-607, Grounding and Bonding

1.3 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of Section 280500 and General Conditions of Contract.

2 PRODUCTS

2.1 GENERAL DESCRIPTION

A. All grounding and bonding connections shall be solderless except where indicated otherwise on the drawings or hereinafter. Grounding shall be performed in strict accordance with the NEC, particularly Article 250 as applicable.

B. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.

C. It is essential and extremely important that the contractor familiarize himself thoroughly with all applicable codes prior to the installation of grounding system. All ground conductors, methods of installation, etc., shall be in accordance with Code requirements.

2.2 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for

all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per the NEC.

B. All connection of ground conductors to ground rods, bus bars, rebar, structural members, pipes or fences, and splices of ground conductors, shall be made by exothermic welds except where otherwise noted. All connections to bar lugs shall be exothermic weld or compression type. Bolted type connection of ground conductors may only be made where terminal lugs or blocks have been furnished and installed in equipment by the manufacturer. The basis of design for exothermic welds shall be the "Cadweld" process manufactured by Erico.

C. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be solid bare copper wire.

D. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

2.3 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL standards and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 280500 and manufacturer’s recommendations.

3.2 GENERAL

A. Ground Electronic Safety and Security systems and equipment in accordance with requirements of the National Electrical Code and as indicated on the drawings.

B. Equipment Grounding: Metallic structures enclosures, raceways, junction boxes, outlet boxes, cabinets, equipment frames, and other conductive items utilized in conjunction with the Communications system(s) shall be bonded and grounded.

3.3 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

B. Arrange for observation of all such connections by the local Electrical Inspector prior to connections being covered or becoming otherwise inaccessible.

3.4 GROUNDING CONNECTIONS SUBJECT TO MECHANICAL INJURY

A. Where grounding conductors are subject to mechanical injury, they shall be protected by encasement in concrete or installed in a rigid metallic raceway.

3.5 SECONDARY EQUIPMENT AND CIRCUITS

A. Conduit Systems:

1. Ground all metallic conduit systems in accordance with NEC requirements.

2. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

B. Boxes, Cabinets, and Enclosures:

1. Bond each pullbox, junction box, outlet box, device box, cabinets, and other enclosures utilized in conjunction with Electronic Safety and Security systems.

2. Provide lugs in each box and enclosure for grounding conductor termination.

3.6 ELECTRONIC SAFETY AND SECURITY SYSTEMS

A. Perform installation of Electronic Safety and Security system grounding and bonding infrastructure in accordance with applicable codes, ANSI/TIA/EIA-607, and the latest edition of National Electrical Code.

B. Ground and bond Electronic Safety and Security systems equipment, cabinets, frames, voltage protectors, cable shields, building structural steel, metallic raceways for cables, etc., in accordance with above referenced codes and standards and equipment manufacturer’s recommendations and requirements.

END OF SECTION

SECTION 280529 – HANGERS AND SUPPORTS FOR ELECTRONIC SAFETY AND SECURITY

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. This Section includes secure support from the building structure for Electronic Safety and Security systems items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.2 QUALITY ASSURANCE

A. The supporting devices, including all necessary components and associated accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Underwriters Laboratory (UL) listed and labeled.

B. Comply with the current governing building codes regarding restraints due to earthquake loads.

2 PRODUCTS

2.1 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.2 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:

1. Expansion Anchors: Carbon steel wedge or sleeve type.
2. Toggle Bolts: All steel springhead type.
3. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. U-Channel Systems: Min. 16-gage steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

2.3 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:

a) Up to 6-inch: 16-gage.

b) Over 6-inch: 14-gage.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

3 EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten Electronic Safety and Security systems components securely and permanently from the primary building structure in accordance with National Electrical Code requirements.

B. Coordinate with the building structural system and with other work installations.

C. Raceway and Cable Supports: Comply with National Electrical Code and the following requirements:

1. Support all cables at intervals not exceeding 6 feet.

2. The use of wire ties for raceway and component attachment, or for permanent attachment of cables, is <u>not</u> permitted.

3. Conform to manufacturer's recommendations for selection and installation of supports.

4. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four.

a) Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.

5. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

6. Support parallel runs of horizontal raceways together on trapeze-type hangers.

7. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

8. Space supports for raceways in accordance with the NEC.

9. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

10. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

D. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

E. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

F. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant or system in gaps between sleeves and enclosed conduits and cables in accordance with “Firestopping” requirements of Section 280500.

G. Conduit Seals: Install seals for conduit penetrations of exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

H. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

END OF SECTION

SECTION 270533 – RACEWAY AND CONDUIT FOR ELECTRONIC SAFETY AND SECURITY

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Raceways for Electronic Safety and Security systems cabling and wiring; complete, including all necessary elbows, couplings, fittings and associated accessories. Types of raceways in this section include the following:

   a) Rigid Metal Conduit

   b) Electrical Metallic Tubing

   c) Flexible Metal Conduit

   d) Liquidtight Flexible Metal Conduit

   e) Rigid Nonmetallic Conduit

   f) Conduit Bodies

   g) Wireway

1.2 QUALITY ASSURANCE

A. The raceways, including all necessary elbows, couplings, fittings and associated accessories shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)

2. National Electrical Manufacturers Association (NEMA)

3. Underwriters Laboratory (UL) listed and labeled.

1.3 RECORD DOCUMENTS

A. Document the following on final set(s) of As-Built drawings:

1. Routing of raceways and conduits utilized for riser and “backbone” cabling distribution (including notation of conduit rises, conduit drops and locations of junction boxes).

1.4 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of Section 280500 and General Conditions of Contract for the following equipment:

1. All Conduit Types (utilized on the project)

2. Conduit Bodies

3. Wireway

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Conduit:
   a) Allied Tube & Conduit
   b) Wheatland Tube Company
   c) Eastern Wire & Conduit
   d) Western Tube & Conduit
   e) Cantex
2. Conduit Bodies:
   a) Thomas & Betts
   b) Oz-Gedney
   c) Crouse-Hinds
3. Wireway:
   a) Hoffman
   b) Square D
   c) Hubbell-Wiegmann

2.2 RIGID METAL CONDUIT

A. Rigid metal conduit (RGS) shall be made of zinc-coated steel piping complying with ANSI C80.1 and UL 6. It shall be of sufficient weight and toughness to withstand cracking and peeling during bending. Galvanizing shall consist of a coating of zinc of uniform thickness applied to inside and outside of walls by either electrolytic or hot metal dip process.

B. Each piece of conduit shall be straight, free from blisters and other defects, cut square and taper reamed and shall be furnished in 10 foot lengths, threaded at each end. Couplings shall be supplied at one end and protection for the other end. All threads shall be cleanly cut. Each length shall bear the Underwriters' Label.

C. Fittings:

1. Comply with NEMA FB 2.10-2007, Selection and Installation Guidelines for Fittings for Use With Non-Flexible Metallic Conduit or Tubing.
2. Zinc-coated steel, if size 2-1/2 inches or less, and zinc-coated malleable iron if larger. Dependent upon application, fittings shall be rated rain tight or concrete tight when applicable.

2.3 ELECTRICAL METALLIC TUBING

A. Electrical Metallic Tubing shall be the same general construction as rigid metal conduit specified above, except for wall thickness and fittings, which shall be zinc-coated steel compression type for all sizes. Set screw type fittings will not be acceptable.

B. Electrical Metallic Tubing shall be constructed in compliance with ANSI C80.3 and UL 797.

2.4 FLEXIBLE METAL CONDUIT

A. Flexible Metal Conduit shall be made of helically wound, formed, interlocked zinc-coated steel strip complying with UL 1. It shall be of sufficient weight and toughness to withstand damage during bending.

B. Cut ends shall be trimmed or otherwise finished to remove rough edges.

C. Fittings shall be constructed of zinc-coated steel, if size 3/4 inch, and zinc-coated malleable iron if larger. Fittings shall be squeeze/clamp type with deep slotted machine screw for securing conduit.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Liquidtight Flexible Metal Conduit shall consist of an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible zinc-coated steel core complying with UL 360. It shall be of sufficient weight and toughness to withstand damage during bending.

B. Fittings shall be constructed of zinc-coated steel, if size 1 inch or less, and zinc-coated malleable iron if larger. Fittings shall be compression type with steel ferrule and neoprene gasket sealing rings.

2.6 RIGID NONMETALLIC CONDUIT

A. Rigid Nonmetallic Conduit shall be constructed of Schedule 40 polyvinyl chloride (PVC), sunlight resistant, rated for use with 90 degree Celsius conductors and in compliance with UL 651.

B. Fittings and cement designed especially for this type of conduit shall be used throughout. Conduit shall be firmly anchored in trenches. Wherever possible, offset fittings shall be avoided and conduit shall be swept to radius and bent as required.

2.7 CONDUIT BODIES

A. General: Provide types, shapes and sizes as required for the application. Conduit Bodies shall have threaded hubs and removable gasketed covers secured with zinc-coated steel screws.

B. Metallic Conduit and Tubing: Conduit Bodies shall be constructed of zinc-coated iron.

C. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies suitable for the application and approved for use with the raceway.

2.8 WIREWAY

A. General: Furnish and install wireway of proper types, sizes and number of channels as shown on the drawings or required per the application and field conditions. Wireways and associated fittings shall be constructed in accordance with UL 870.

B. Covers shall be hinged, removable and capable of being reinstalled without tools. Provisions shall be included in the construction to allow screwing the hinged cover closed without the use of parts other than the standard lengths, fittings and connectors. It shall also be possible to seal the cover in a closed position with a sealing wire. Wireway shall be constructed with knockouts.

C. All sheet metal parts shall be provided with a rust inhibiting phosphatizing coating and gray baked enamel finish. All hardware shall be plated to prevent corrosion. All screws installed toward the inside shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage.

D. All connectors shall be slip-in type with self-retained mounting screws. All hangers shall be two-piece with hook together feature to permit preassembly of wireway and hanger bottom plate before hanging on preinstalled upper bracket.

E. Wireway shall be so installed that the hinged cover surface is in the vertical position to allow for easy accessibility to conductors and preclude the spilling of conductors when cover is opened.

F. All lengths, connectors and fittings shall be UL labeled and installed in accordance with the National Electrical Code and as shown on the drawings. UL listing of lengths without listing of connectors or fittings is not acceptable.

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of Section 280500 and manufacturer’s recommendations.

B. The entire conduit installation shall be concealed in the construction except that it may be run exposed in unfinished areas and mechanical rooms. Where un-plastered concrete slab ceilings occur, conduit shall be installed in ceiling slab. No exposed conduits will be permitted on finished walls or ceilings, unless otherwise noted.

C. Rigid metal conduit shall be furnished and installed below concrete slabs on grade, within walls or in "web" (void) of metal decking above grade.

D. Rigid metal conduit is permitted to be installed within concrete slabs, provided that both:

1. Minimum concrete slab thickness is 4 inches

2. Concrete slab provides not less than 2 inches cover over conduit.

E. Electrical metallic tubing may be utilized at all other locations as allowed by the National Electrical Code, except where subject to damage or otherwise specified.

F. Do not install conduit in stone/cinder fill. However, where this is impracticable, utilize GRS conduit encased on all sides by not less than 2 inches of concrete.

G. Utilize fittings marked “Concrete-tight” or “Raintight” where conduit is intended for embedment in poured concrete. Utilize fittings marked “Raintight” or “Wet locations” where conduit is intended for installation underground, outdoors, or in wet locations. Threaded fittings shall be made up wrench tight.

H. Conduits shall be run as straight and direct as possible to limit number of bends or offsets to a minimum. Exposed conduits shall be installed with runs parallel or perpendicular to walls and ceilings, and with right angle turns utilizing conduit bodies or symmetrical bends. Exposed vertical conduit runs shall be run on the building walls or columns, where possible. Where switch and receptacle outlets occur in exposed runs, zinc-coated cast iron device boxes shall be used at these locations. Review all portions of exposed raceways in finished areas with the Architect prior to installation.

I. Not more than the equivalent of four (4) 90-degree bends will be allowed in any one run of conduit. Where more bends are necessary, a pull box shall be installed. All couplings shall be pulled up tight so as to provide an electrical bond throughout the entire conduit system.

J. No conduit smaller than 3/4 inch trade size shall be used in any part of the various systems, nor shall the conduit be smaller than the size recommended by the manufacturer(s) of the Electronic Safety and Security system(s). Secure this information from the equipment manufacturer(s) prior to rough-in. Crowding wiring will not be permitted.

K. Conduit bends shall be of the large radius, machine-made, without kinks, flattening or crushing. Conduit may be bent by using an approved pipe bending machine or hickey.

L. Conduits installed directly under roof decking shall be installed a minimum distance of 1 1/2” below the roof deck.

M. Conduit ends shall be square cut and reamed to remove burrs. Cut EMT utilizing a hack saw or band saw; do not use roll-type tubing cutters. Conduit shall be installed in such a manner that wires may be removed and replaced at a later date.

N. Approved threaded couplings, such as the 3-piece coupling (Erickson) or suitable union, shall be used where construction requires the use of a union. Running threads will not be permitted. Expansion fittings shall be used where conduit crosses expansion joints.

O. Where steel conduit is threaded in the field, the thread shall be coated with an approved electrically-conductive, corrosion-resistant compound. Coatings for this purpose, listed under UL category “FOIZ” are available; zinc-rich paint or other coatings acceptable to the AHJ may also be used.

P. Raceway supports shall be installed and supported in accordance with requirements of the National Electrical Code and specification section 280529. Raceways are permitted to be mounted directly to the building structure. Assure that supporting means and associated fasteners are compatible with the mounting surface from which they are supported.

Raceways supports shall be installed only on conduit of the trade size indicated on the fitting (or smallest respective shipping container).

Q. Each end of every conduit run terminating in a pressed steel box of any type shall be provided with a galvanized locknut and bushing inside and a locknut outside. All feeder conduits shall be provided with hardwood or fiber bushings at all junction boxes, panels, etc.

R. Do not rely upon locknuts to penetrate nonconductive coatings or finishes on enclosures. Such coatings shall be removed *in the locknut contact area only* prior to raceway assembly, to ensure continuity of ground path. Touch up bare areas as needed after fitting assembly.

S. Outlet, junction and pull boxes shall be securely anchored to structural members as required or indicated on the drawings and not dependent on conduit for support. If structural members are not provided at locations of boxes for support, this contractor shall furnish and install same.

T. A separation of 6 inches shall be maintained between all conduit and hot water, steam lines and flues in the building. Where conduits, hot water and steam lines are closer than 6 inches an approved pipe covering shall be used over the conduit for the length of the run of such exposure.

U. Provide temporary closure protection for conduits during construction to prevent foreign matter from entering raceways. Provide conduit caps for empty conduits that are installed as spares to prevent foreign matter from entering raceways.

V. Raceway systems shall be installed complete, including tightening of joints, from termination point to termination point prior to the installation of conductors.

W. Install nylon pull line in empty raceways.

3.2 FIELD ADJUSTMENTS

A. Perform field adjustments to the raceway systems as required. The adjustments shall include, but not be limited to: inspecting the interiors of raceways; clearing blockages and removing burrs, dirt, and construction debris.

END OF SECTION

SECTION 280534 – BOXES FOR ELECTRONIC SAFETY AND SECURITY

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. This section includes boxes, cabinets and fittings for Electronic Safety and Security systems installations and certain types of fittings not covered in other sections. Equipment specified in this section includes but is not limited to the following:

   a) Outlet and device boxes

   b) Pull and junction boxes

   a) Cabinets

   b) Composite Service Boxes (handholes)

1.2 QUALITY ASSURANCE

A. The boxes, cabinets, fittings, etc. included in this specification section shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)

2. National Electrical Manufacturers Association (NEMA) 250

3. Underwriters Laboratory (UL) listed and labeled.

1.3 SUBMITTALS

A. Submit product data sheets to Engineer in accordance with requirements of section 280500 and General Conditions of Contract.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Outlet, device, pull and junction boxes:

   a) Thomas & Betts

   b) E-Box

   c) Raco (Hubbell Electrical Products)

   d) O-Z/Gedney

2. Cabinets:

   a) Hoffman

   b) E-Box

c) Picoma Industries

3. Composite Service Boxes (handholes):

a) Quazite

b) Synertech

c) Pencell Plastics Inc.

2.2 BOXES, CABINETS AND FITTINGS

A. General: Furnish and install proper types, sizes and NEMA classes as shown on the drawings or required per the application and field conditions. Provide complete with covers and accessories required for the intended use. Provide gasketed covers for boxes, cabinets and fittings located in damp or wet environments, or otherwise noted.

B. Materials and Finishes:

1. Sheet Steel: Flat-rolled, code-gage, galvanized steel.

2. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

3. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

4. Cast Metal for Boxes, Enclosures and Covers: Galvanized, cast iron alloy or copper-free aluminum with corrosion resistant finish.

5. Finish: The interior and exterior of items exposed in finished locations shall be baked enamel. Verify color selections with Architect.

6. Fittings for Boxes, Cabinets and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

C. Metal Outlet, Device and Small Wiring Boxes:

1. General: Conform to UL 514A & UL514B.

2. Steel Boxes: Conform to NEMA OS 1. Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.

a) Outlet and device boxes shall be standard (2-1/4” deep) electrical boxes; shallow (1-1/2” deep) outlet boxes shall not be utilized, except where specifically noted or directed.

3. Cast Metal Boxes: Cast metal, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs. Provide with gasketed cover.

D. Pull and Junction Boxes:

1. General: Comply with UL 50 for boxes over 100 cubic inches volume. Boxes shall have screw or bolt on covers of the same material as the box.

2. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.

3. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.

4. Cast Metal Boxes: Cast metal, waterproof, with threaded raceway entries and features and accessories suitable for each location. Provide with gasketed cover.

E. Cabinets

1. General: Comply with UL 50.

2. Construction: Sheet steel of size and NEMA class as shown on the drawings or required per the application and field conditions. Cabinet shall consist of a box and a front consisting of a one-piece frame and a hinged door with flush or concealed door hinges. Provide double door for cabinets wider than 24 inches. Signal system cabinets wider than 48 inches may have sliding or removable doors.

3. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power and lighting system cabinets located within mechanical and electrical rooms. Doors with locks shall be capable of closing without locking.

2.3 COMPOSITE SERVICE BOXES (HANDHOLES)

A. Provide service boxes constructed of polymer concrete reinforced with heavy-weave fiberglass. Minimum compressive strength of material shall be 11,000 psi. Provide heavy-duty covers (minimum 15,000 lb. Over 10 inch square area) with the service identification cast into cover, i.e. TELEPHONE. Provide base section and stackable extensions as required for the installation. Include stainless steel bolts to secure cover.

3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install in accordance with requirements of Section 280500 and the manufacturer’s recommendations.

2. Supports for boxes shall be installed in accordance with requirements of specification section 280529 and the National Electrical Code.

3. Locations: Install items where indicated and where required to suit code requirements and installation conditions.

4. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

5. Sizes shall be adequate to comply with NEC volume requirements, but in no case smaller than sizes indicated.

6. Remove sharp edges where they may come in contact with wiring or personnel.

7. Secure boxes firmly in place and set true, square with building lines.

B. Applications:

1. Cabinets: Flush mounted, NEMA enclosure type 1 except as otherwise indicated.

2. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:

   a) Interior Dry Locations: Sheet steel, NEMA type 1.

   b) Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R.

   c) Wet Locations: NEMA type 4 enclosures.

3. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

4. At locations where special boxes are required for systems, boxes shall be of the type and size as recommended by the respective system manufacturer.

C. Installation of Outlet Boxes:

1. Outlets at Windows and Doors: Locate close to window trim. For outlets indicated above doors, use mounting height as noted and center outlets above the door opening except as otherwise indicated.

2. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions.

3. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets, or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes flush with the face of the tile or other finish, without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.

4. Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:

   a) Exterior locations.

   b) Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).

   c) Where exposed to moisture laden atmosphere.

   d) At food preparation equipment within four feet of steam connections.

   e) Where indicated.

5. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

6. Mounting: Mount outlet boxes for switches and receptacles with the long axis vertical or as indicated. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes

for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.

7. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.

8. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

9. Concrete Boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6-inch depth.

D. Installation of Pull and Junction Boxes:

1. Size: Pull and junction boxes for feeder and branch circuits shall be of adequate size to comply with NEC volume requirements, but in no case smaller than sizes indicated.

2. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30-inches inside boxes.

3. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.

4. Signal Systems: Provide pull and junction boxes for telephone, data and other signal systems at least 50 percent larger than would be required by NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

E. Installation of Cabinets:

1. Mount with fronts straight and plumb.

2. Install with tops 78-inches above floor.

3. Set cabinets in finished spaces flush with walls.

F. Installation of Composite Service Boxes (Handholes):

1. Set service boxes on compacted subbase material.

2. Backfill around service boxes with subbase material.

3. Install top of service boxes flush with adjacent grade.

G. Grounding:

1. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

3.2 FIELD ADJUSTMENTS

A. Inspect components and perform field adjustments as required. Adjustments shall include, but not be limited to: removing burrs, dirt and construction debris; and repairing damaged finish including chips, scratches, abrasions and weld marks as follows:

1. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the manufacturer.

2. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating. Paint exterior junction box covers as directed by the Architect.

END OF SECTION

SECTION 281316 - ACCESS CONTROL SYSTEMS

1 GENERAL

1.1 SECTION INCLUDES

A. Performance of all labor and providing and installing all materials, components and accessories as required for the construction of the project as indicated by contract documents.

B. Equipment specified in this section includes but is not limited to the following:

1. Hardware and Software
2. Accessories

1.2 WORK INCLUDED

A. The work includes furnishing all labor, materials, tools, equipment, and documentation required for a complete and working Security Management Information System [SMIS] as specified in this document.

B. All wiring for this system shall be installed within metallic conduit.

1.3 SPECIFIED SYSTEM

A. The SMIS specified is that of Siemens. Catalog and model numbers are intended to establish the type and quality of equipment and system design as well as exact operating features required.

B. The equipment supplied shall be a standard labeled product of the equipment manufacturer, bearing the company's name and having their exclusive model numbers. This company must be of established reputation and experience, regularly engaged in the manufacture, supply and support of such systems for a period of at least five consecutive years under the current company name. This company shall have a fully staffed office of sales and technical support representatives within 50 miles of this project.

1.4 SCOPE OF SYSTEM

A. The contractor shall furnish and install all labor, equipment, accessories and materials required for the installation of a comprehensive Security System in strict compliance with these specifications and as shown on all applicable contract drawings.

B. Any material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of this specification.

C. This section includes the labor, materials, tools, equipment and documentation required for connecting and integrating access control equipment in order to provide a new security system as specified in this section. The intent of the work and equipment specified in this section is to define layout, installation, hardware, documentation, inspection, testing, training, and start-up requirements.

D. The contractor shall be responsible for all wiring, programming, alarms, reports and graphic displays to make the Security System a complete and functioning system as described in this section.

E. The contractor shall be responsible for the installation and connection of all key pads, door contacts, request to exit devices, security access panels, cameras, monitors, digital video recorders, intercoms, and wiring to accomplish the intent of this work.

F. The contractor shall be responsible for ensuring proper function and operation of the Security System at all interface points with other systems in this project, including door hardware, Building Automation, Fire Alarm, and others as specified.

G. The contractor shall provide and install relay wires to the building fire system to enable the unlocking of the electric locks upon fire alarm. Terminations to the fire system to be provided by the owner. The contractor shall coordinate with the building fire system vendor for testing.

H. The contractor shall be responsible for all electronic locking hardware and lock power supplies required for this project. All request to exit devices are to be supplied as an integral part to the locking hardware.

I. The complete installation shall conform to the requirements set forth by the NEC, all State and Local Building Codes, as required by the “Authority Having Jurisdiction” and the requirements of the owner.

J. Work under this section shall be accomplished by a Systems Integrator who has twenty (20) years of demonstrated experience installing similar types of systems. The Systems Integrator shall provide all labor, material, equipment and services for the complete and proper operation of all systems indicated, required or implied by the drawings and specified within.

K. The Systems Integrator shall provide the services of a Factory Trained Technician to supervise, commission and make final system adjustments to the specified systems. This Technician, in the presence of the owner’s representative shall test the system in its entirety.

1.5 REFERENCES

A. Design and operation of the system shall conform to the following referenced codes, regulations, and standards as applicable:

1. National Electrical Code (NEC)
2. UL 294, UL864 and UL 1076
3. FCC Rules and Regulations
   a) Part 15, Radio Frequency Devices
4. National Electrical Manufacturers Association (NEMA)
   a) Section 250, Enclosures for Electrical Equipment
5. Applicable Federal, State, and Local laws, regulations, and codes.

1.6 SUBMITTALS

A. Submit all items in accordance with the requirements of Section 280500 including but not limited to the following:

1. Model numbers of all components furnished on the job
2. Manufacturers catalog data sheets for all components
3. Input power requirements for all components
4. Complete engineered drawings indicating:
   a) Manufacturer model numbers and specifications
   b) Dimensions, layouts, installation details
   c) Point-to-point wiring diagrams for all devices
   d) Termination details for all devices
   e) Single-line system architecture drawings representing the entire system
   f) Interfaces with all sub-systems, if any.

1.7 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers:

1. Siemens Industry, Inc. Building Technologies Division
2. Wanderguard

1.8 SYSTEM CERTIFICATIONS

A. The system shall be listed by Underwriters Laboratories (UL) for UL294 Access Control Systems Units.

B. All operator stations, controllers and keypads furnished on the project shall carry UL294 labels as applicable. Bidders shall also provide copies of the UL listing cards or other proof of compliance upon request, for all components included in the submittal.

1.9 GENERAL PRODUCT DESCRIPTION

A. The Security System shall consist of:

1. A fully automated and integrated computer-based Keypad Access Control and Alarm Monitoring System.
2. A basic visitor management system consisting of audio visual intercom call in stations, and intercom masters.
3. Automated keypad access control at designated areas, doors, etc.
4. Security alarm monitoring and reporting of alarm and trouble conditions detected by sensors and/or devices at the access controlled doors.
5. Audio/Visual Intercom call stations and master stations at designated locations.

6. The system shall provide full Integration with the capability to administer Access Control and Alarm Monitoring through one graphical user interface.

7. The Security System shall be capable of software interface to Siemens Apogee Building Automation.

B. The system shall be at the time of bid, if required, listed by Underwriters Laboratories listed for UL 294 Access Control Systems, and UL 1076 Proprietary Burglar Alarm Systems. PC's, and all control panels furnished on the job shall carry the UL 294 and UL 1076 labels as required. Bidders shall also provide copies of their UL listing cards or other proof of compliance before the award of a contract.

C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of control panels, keypads, and sensors.

D. The system shall incorporate the necessary hardware, software, and firmware to collect, transmit, and process alarm, tamper and trouble conditions, access requests, and advisories in accordance with the security procedures of the facility. The system shall control the flow of authorized personnel traffic through the secured areas of the facility.

E. The user interface at the host computer (server) and at the optional OWT (operator workstation terminal computers) shall be a mouse driven graphical user interface (GUI) allowing the user to open and work on multiple windows simultaneously.

1.10 SYSTEM DESCRIPTION

A. Door leaves shall automatically unlock in the direction of egress upon loss of power to the sensor or to the part of the access control system that locks the door leaves.

B. Reference Architect's door hardware specifications for door operation with associated door hardware.

C. An irreversible process shall release the lock in the direction of egress within 15 seconds, or 30 seconds where approved by the authority having jurisdiction, upon application of a force to release device under all of the following conditions:

1. The force shall not be required to exceed 15 lbf.

2. The force shall not be required to be continuously applied for more than 3 seconds.

3. The initiation of the release process shall activate an audible signal in the vicinity of the door opening.

4. Once the lock has been released by the application of force to the releasing device, relocking shall be by manual means only.

D. A readily visible, durable sign in letters not less than 1 inch high and not less than 1/8 inches in stroke width on a contrasting background that reads as follows shall be located on the door leaf adjacent to the release device in the direction of egress: PUSH UNTIL ALARM SOUNDS DOOR CAN BE OPENED IN 15 SECONDS.

E. Activation of the building fire-protective signaling system, if provided, shall automatically unlock the door leaves in the direction of egress, and the door leaves shall remain unlocked until the fire-protective signaling system has been manually reset.

2 PRODUCTS

2.1 MATERIALS

A. All products and materials are to be new and free of defects, damage and corrosion. All materials shall be in compliance to all applicable codes and designed specifically for the function intended.

B. Wire and cable - All wiring and cabling shall be per the manufacturers' recommendations. Unauthorized deviations may result in the voiding of the manufacturer's warranty.

2.2 WARRANTY

A. All products and materials must include a manufacturer’s minimum one-year warranty. The warranty shall include material and labor to repair faulty equipment.

2.3 SYSTEM HARDWARE

A. Security System File Server

1. The file server shall be provided with 17-inch LCD monitor, standard 101-key keyboard and two-button mouse. The file server computer system shall be constructed from commercially available computer hardware.
2. The file server shall utilize the latest Intel Pentium processor operating at a minimum of 2.0 GHz supporting true multi-user, multi-tasking and multi-threaded capabilities with a minimum of 512 Mbytes of RAM. The file server shall be capable of directly supporting up to 19 serial ports. The file server shall be capable of supporting at least two printers
3. The file server system shall utilize the latest Microsoft Windows operating system
4. The file server shall be supplied with an Ethernet network interface card that supports 10/100 topologies. The system shall be capable of running and supporting TCP/IP network protocol.
5. The system shall be optionally capable of supporting a true fully hot redundant file server configuration; warm stand-by, hot standby, and RAID configurations are not acceptable and will be rejected.
6. The system shall be capable of supporting 32 SiPass client workstations.
7. The system shall be provided with a fixed hard disk drive with a capacity of at least 40GB and shall be provided with a removable hard disk drive, directly accessible from the on-line system, with a capacity of at least 1 GB for archiving, and archive reporting purposes. Event transaction data copied and archived to a removable hard disk cartridge shall be capable of being accessed directly from the on-line operational system application programs and menus.

[The system shall support a RAID (redundant array of inexpensive disks) fixed hard disk system.]

8. The computer system shall be capable of accommodating upgrades in color monitor, hard disk drive, RAM and I/O port capacity, without rendering the SiPass file server hardware and/or software obsolete.

B. Security System Client Workstation

1. The client workstation shall be provided with 17-inch LCD monitor, standard 101-key keyboard and two-button mouse. The computer system shall be constructed from commercially available computer hardware. The client workstation shall utilize a minimum Intel Pentium 4 processor supporting true multi-user, multi-tasking capabilities with a minimum of 128Mbyte of RAM. The system shall be capable of supporting up to two serial I/O ports (expandable to four or more) and at least two parallel ports. Each client workstation shall be capable of supporting at least two printers.

2. The client workstation shall utilize the latest Microsoft Windows operating system.

3. The client workstation shall be supplied with Ethernet network interface card that supports 10/100 topologies.

4. Each client workstation shall be capable of supporting alarm color graphics, photo badging for enrollment and verification, video imaging from the ACC panels. The workstation shall be equipped with the standard SiPass operator software package, and shall be provided with USB connection to support the photo badging camera system.

C. Optional Report Printer

1. Operator requested and specified database reports shall print on a system report printer. The report printer shall be an HP Laser Jet 1012 Laser Jet printer.

D. Advanced Central Controller

1. 4 x Field Level Network (FLN channels for local device connection

2. Multi-tasking microprocessor-based platform

3. 32-Bit Processor

4. 64MB RAM

5. Diagnostic port for real time system maintenance

6. Flash memory for remote firmware updates

7. Ethernet port for connection to the host system using TCP/IP

8. Configurable RS-232 / RS-485 / RS-422 for high level interfaces

9. Real time clock battery

10. Local tamper input

11. Local alarm output

12. 21 Status LEDs

E. Reader Interface Module (RIM)

1. The Reader Interface modules shall be provided to support all keypads, door contact switches, request-to-exit devices and electric locks. The RIM modules shall support all industry standard keypads and compatible biometric devices. These modules shall be available in configurations suitable to support the connection of one, two card devices as required.

2. Each RIM module shall support five-state supervised input points, output relays, and shall provide power outputs of 5 VDC, 12 VDC and 24 VDC output at 500 mA to power card readers, biometric devices, request to exit (REX) devices and door strikes.

3. RIM modules shall utilize on-board self-diagnostic LEDs, removable terminal strips and pop-in/pop-out circuit boards.

4. RIM modules shall be supplied with all specified options available, including an enclosure with an enclosure tamper switch.

5. Quantity and location of RIM modules shall be as specified in contract documents and drawings.

F. Optional Input Point Module

1. The Input Point Module (IPM) shall be provided to support additional input points. The IPM shall support all industry standard alarm input devices.

2. Each IPM shall support 32 five-state supervised input points and four output relays. The status of each input point shall be indicated by a tri-state LED, and shall be available if required with an enclosure through which these status LEDs can be viewed, and it shall be possible to append legends denoting the connection details of each input point on the outside of the enclosure.

3. Each IPM shall utilize on-board self-diagnostic LEDs, industry standard terminal strips and a pop-in/pop-out circuit board.

4. Each IPM shall be supplied with all specified options available, including an enclosure with a tamper switch. Quantity and location of remote input modules shall be as specified in contract documents and drawings.

G. Optional Output Point Module

1. The Output Point Module (OPM) shall be provided to support additional output relays. The OPM shall utilize industry standard dry contact output relays.

2. Each OPM shall support eight SPST and eight DPDT output relays.

3. Each OPM shall utilize on-board self-diagnostic LEDs, and a pop-in/pop-out circuit board.

4. Each OPM shall be supplied with all specified options available, including an enclosure with a tamper switch. Quantity and location of OPMs shall be as specified in contract documents and drawings.

H. Keypads

1. Readers shall be Indala 125 kHz Keypad Readers
2. Operating voltage 4 – 16 DVC
3. Current requirements – 75ma
4. Dimensions – 4.5”H x 3.0”W x .07”T
5. Operating temperature - -22 to 149 Degrees F
6. Outputs – 8 bit burst, buffered Wiegand data or a 3 x 4 matrix output
7. ASSA ABLOY FP5061B or equal

I. Door Contact Switches

1. Surface Mount or Recessed Mount concealed magnetic contact switches shall be provided to monitor the status of each keypad controller door and auxiliary door as noted on the contract drawings.
2. Quantity and location of door contact switches shall be as specified in contract documents and drawings.
3. Sentrol model 1085T or 1078

J. Request-to-Exit Devices

1. Request-to-exit devices shall be provided to allow a person to exit an access controlled door.
2. Detection Systems model DS160i
3. Request-to-exit Devices shall be installed in accordance with any applicable building or life safety codes requiring free egress during an emergency.

K. Push-to-Exit Devices

1. Push-to-exit devices shall be provided to allow a person to exit an access controlled door.
2. Push-to-exit Devices shall be installed in accordance with any applicable building or life safety codes requiring free egress during and emergency.

2.4 SYSTEM SOFTWARE

A. The software, as supplied by the successful contractor:

1. The system design shall be object oriented and shall be a native 32-bit application running under the latest Microsoft Windows operating system. All client workstations and the server(s) shall have full system functionality and shall not be segregated in any way by function, except as defined by the user authentications of sign on and password.

B. The system shall have a simple, easy to use graphical user interface and all functions shall be accessible by use of either mouse or keyboard. Help text shall be provided for each screen function, and shall be sufficiently interactive that a user may access page help directly and be provided with explicit information relevant to the particular screen being displayed.

1. The access control system software shall be capable of supporting the following features:
   a) Advanced Alarm Management
   b) Configurable event task routines
   c) Intelligent built-in report generator
   d) Support for customization
   e) Guard tour
   f) Dynamic full-color graphics
   g) Image verification
   h) Multiple tenant support
   i) Mifare encoding
   j) Interface to T&A applications
   k) Configurable operator privileges and advanced database partitioning
   l) Workgroup access permissions
   m) Real-time event and message logging
   n) Comprehensive symbols library
   o) Time scheduling
   p) Color coded alarm display
   q) 1000 configurable alarm priority levels
   r) Database import and export
   s) Programmable holidays
   t) Support for all popular reader technologies
   u) External software interface (OPC alarm & events)
   v) Alarm forwarding
   w) Supports co-standby server redundancy
   x) Support for 30 different file formats, including AutoCAD files
   y) Operates under latest Windows operating system
   z) Supports SQL2000 & MSDE databases
   aa) Multi-user, multi-tasking environment
   bb) Full password encryption or Windows authenticated log-on
   cc) Intuitive Graphical Interface (GUI)
   dd) Powerful client server architecture
   ee) Comprehensive On-line help
   ff) Visitor Management

gg) Digital Video Integration

hh) CCTV Switcher Interface

ii) Human Resources Integration

3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with requirements of 281316 and manufacturer's recommendations.

B. Coordinate the operational compatibility of all locking devices with the Access Control manufacturer.

C. If required by the Access Control manufacturer, the locking devices supplier shall include electronic suppression.

D. All wiring shall be provided by this contractor in accordance with respective equipment manufacturer’s recommendations.

E. All locking device wiring shall be run separate from all other system wiring except wire specifically permitted by the Access Control supplier.

3.2 TRAINING AND INSTRUCTION

A. Before the system is turned over to the owner the manufacturer shall provide one (1) eight-hour day of system operations training at the project site or a mutual agreed upon convenient location for up to 10 of the owners representatives meeting a minimum expected level of computer competence. This training shall be conducted during normal business hours of the equipment supplier at a date and time of mutual convenience. Should additional people or training time be required, this may be contracted for, at an additional fee by the owner at a time and date mutually convenient to both parties.

3.3 WARRANTY

A. The system shall be warranted for a period of 1 year from date of acceptance. Written notification shall be sent to the owner stating the date this warranty period has started.

B. The equipment manufacturer shall make available to the owner a proposal for an optional maintenance contract, providing a minimum of two inspections and test per year.

END OF SECTION

SECTION 281328 - DOOR COMMUNICATION SYSTEM

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Door communication system; complete, ready for operation, including all cables, raceways, pull boxes, outlet boxes, connectors, adapters, splitters, couplers, taps, mounting hardware, amplifiers, equalizers, power supplies, tests, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.

1.2 QUALITY ASSURANCE

A. The door communication system, including all necessary parts, accessories, connections and equipment shall be manufactured and installed in accordance with the latest editions and applicable sections of the following codes and standards:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Electrical Manufacturers Association (NEMA)
3. Underwriters Laboratory (UL) listed and labeled.
4. American National Standards Institute (ANSI)
5. Institute of Electrical and Electronics Engineers (IEEE)
6. Federal Communications Commission (FCC)
7. Local Cable Distribution Company Compliance: Provide products that comply with applicable rules and regulations.
8. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises
9. TIA-569-B “Commercial Building Standard for Telecommunications Pathways and Spaces”

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 270500 and General Conditions of Contract:

1. Provide complete submittals, which shall include floor plan drawings indicating device locations, schematic wiring drawings, and spec sheets for all equipment. Partial submittals will not be accepted.
2. Spec sheets shall include data on features, ratings, and performance. Components must show compliance with the performance criteria specified herein.

B. If re-submittals are required, they shall be provided within two (2) weeks after the date of notification. If re-submittals are not received by the Engineer in two (2) weeks, the supplier will be considered nonresponsive and subsequent submittals from the supplier will not be reviewed. The Contractor shall then provide submittals from another equipment supplier within two (2) weeks as directed by the owner at no change in contract price.

C. The cost of review of any submittals after two (2) submittals have been rejected shall be paid by the Contractor to the Engineer. Prior to re-submittal, purchase order shall be delivered to the Engineer before additional reviews of submittal start.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 270500 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Recommended renewal parts list
3. Final as-built drawings
4. Complete Wiring diagrams

1.5 RECORD DOCUMENTS

A. The As-Built drawings shall include three (3) complete sets of 30" x 42" contract base sheet drawings with any and all changes included and noted. The As-Built drawings shall be kept up to date continuously by the electrician in charge of the system installation. These drawings shall be reviewed on a weekly basis for accuracy and completeness.

B. The Operation and Maintenance Manual shall include a complete set of equipment, component and device specification and data sheets, and the name and address of the installer. The manual shall be bound in a black three-ring loose leaf binder with dividers and a table of contents. Three (3) duplicate sets are required.

C. All documents and items described above shall be submitted for approval and turnover prior to the final system testing. Three (3) duplicate sets of the Test Report shall be submitted to the Engineer.

1.6 ACCEPTANCE OF SYSTEM

A. Total acceptance of the system will only be made after the required tests, complete record document package, and the instruction period have been provided.

1.7 GUARANTEE

A. The Contractor shall guarantee labor, materials and equipment provided under this contract against system defects for a period of one (1) year after the date of final acceptance of this work by the Owner.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Aiphone (AX Series)
2. Or Pre-Approved equal

2.2 CATV SYSTEM DESCRIPTION

A. Components:

1. Door stations: Connect one door station in location shown on drawing
2. Master Stations: Connect three master stations in locations shown on drawings
3. Central Exchange Units (CEU): Connect one CEU Model AX-084C in location shown on drawings.
4. Power supply.
5. Other External Connections:
   a) Access control system.
   b) CCTV system.

B. Capacities:

1. Door Stations: Maximum 8 stations with 1 CEU Model AX-084C.
2. Master Stations: Maximum 4 stations with CEU Model AX-084C.
3. Power Supply:
   a) Model PS-2420UL: 24 V DC, 2 A.
   b) For Audio: 1.
   c) For Video: 2.
4. Number of Talk Paths: 2.
5. Number of Video Paths: 2.
6. All Call: 1, to master stations only.
7. Video Monitor: 2, same as talk paths and video paths.
8. Scan Monitor: 1.

C. Calling Master Station from Door Station and Communicating:

D. Priority Levels for Calls from Door Stations:

1. Normal.
2. Priority.
3. Press door station CALL button.

4. Calling tone rings on master station (for normal call, intermittent tremolo sound; for priority call, rapid intermittent tremolo sound) and selector button LED for individual door station flashes (double-flash for priority call). If door station has camera, video from door station shall be displayed on master station monitor. Call tone continues to ring until answered or is timed out (based on setting). You can stop calling tone by pressing OFF button.

5. If you press individual door station selector button, LED stops flashing and stays lit and you can talk hands-free to that station. If only TALK button is pressed to answer call, hands-free communication initiates with door station at highest priority call. Talk LED lights when you talk and goes off as you listen to caller.

6. Press OFF button again to end communication. Call also ends automatically when set talk limit is reached.

7. If you hold down TALK button for a minimum of 1 second, communication switches to press-to-talk mode. Hold down TALK button to talk and release to listen to caller. You cannot switch back from press-to-talk communication to hands-free communication.

8. If other master station presses selector button of in-use door station or in-use master station, busy signal is heard at master station.

9. Microphone is muted while you hold down privacy button on master station while in communication.

10. You can connect footswitch and use it in the same manner as TALK button.

11. Master station can display calls up to 8 stations at the same time. If there are more than 8 incoming calls, they will be displayed in order of priority and time of call.

12. You can adjust calling tone, transmit volume, and receive volume with volume controls at bottom of master station.

13. You can use a headset (not included in system) instead of built-in master station's speaker and microphone.

E. Calling Master Station from Another Master Station and Communicating:

1. Press individual selector button of master station.

2. Pre-tone sounds both master stations and starts hands-free communication. Talk LED lights when you talk and goes off as you listen to caller.

3. Press OFF button to end communication. You can end call from either master station. Call also ends automatically when set communication end time is reached.

4. If called master station has privacy mode set (privacy settings button is lit), communication is only 1-way, from calling master station to called master station, and nothing can be heard from called master side. Press TALK button on called master station for a minimum of 1 second. Press-to-talk communication starts. Hold down TALK button to talk and release to listen to caller.

5. You cannot call master station while it is communicating. You will hear a busy signal.

F. Privacy (PRIV) Function:

1. To make master into privacy mode (prevent monitoring from other stations), press privacy button (LED lights up).
2. To cancel privacy mode, press privacy button again (LED goes out).
3. Privacy setting cannot be changed while in communication.

G. CO Line Call from Door Station and Communication:

1. If CALL button is pressed at door station while CO Transfer feature is set (with CO Transfer button lit), call tone rings on master station (for normal call, intermittent tremolo sound; for priority call, rapid intermittent tremolo sound) and selector button LED for individual door station flashes (double-flash for priority call). At same time, telephone call is placed to programmed CO line number.
2. You can communicate with door station from telephone.
3. You can end communication at telephone. Communication also ends automatically when set talk time limit is reached. About 10 seconds before end of call, you will hear alarm sound on telephone.
4. Maximum duration for CO line call is 300 seconds, even if call timer is set to “Infinite”.
5. Using this function requires Viking Electronics, Inc. “K-1900-5 Hot-Line Pulse Dialer”.
6. If there are multiple calls, call from door station with highest call priority is transferred.
7. Answering at any master station during CO transfer feature will stop CO transfer.
8. There are no functions, such as for door release and dial-in, from telephone.

H. All Call (Normal Master Station Paging):

1. When you press ALL CALL button on master station, all individual master station selector button LEDs flash slowly. You can clear undesired master station from All Call by pressing individual master station selector button with flashing LED, which will turn off LED. Pressing that button again makes that master station part of All Call again and makes LED flash.
2. If you press TALK button, send LED lights up and all individual master station selector buttons stop flashing and stay lit. Pre-tone sounds on target master stations and they can be talked to. At this time, you cannot hear audio from other master stations.
3. Press OFF button to end. You can end call for individual master station by pressing its OFF button.

4. All Call announcements do not go to master stations that are in use.

5. During All Call, if you press individual master station selector button on calling master station or press individual master station selector button or TALK button on 1 of the other master stations, communications switch to hands-free between master stations.

6. There is no function for hands-free reply from called master station during All Call mode.

7. If you press down ALL CALL button but do not start talking within 30 seconds, system goes back to standby mode. You can also return to standby by pressing OFF button.

I. All Call (Priority Master Station Paging):

1. When you press ALL CALL button on master station, all individual master station selector button LEDs flash slowly.

2. If you press ALL CALL button again, flash rate increases. You can clear undesired master station from All Call by pressing individual master station selector button with flashing LED, which will turn off LED. Pressing that button again makes that master station part of All Call again and makes LED flash.

3. If you press TALK button, TALK LED lights up and all individual master station selector buttons stop flashing and stay lit. Pre-tone sounds on all master stations and all can be called. At this time, you cannot hear audio from other master stations.

4. Press OFF button to end. You can end call for individual master station by pressing its OFF button.

5. Communication of master station being used is cancelled and All Call takes priority. Before communication of master station being used is cancelled, you hear cancel warning sound.

6. During All Call, if you press an individual master station selector button on calling master station or press individual master station selector button or TALK button on one of the other master stations, communications switch to hands-free between those two master stations.

7. There is no function for talk back from master station receiving an All Call announcement.

8. If you press down ALL CALL button but do not start talking within 30 seconds, system goes back to standby mode. You can also return to standby by pressing OFF button.

J. Monitor:

1. If you press individual door station selector button, you can hear audio and if that door station has a camera, you can see image.

2. Press OFF button to end. Call also ends automatically when set communication end time is reached.

3. While door station is communicating with or monitored by a master station, you cannot monitor that door station from another master station.

4. If you press TALK button while monitoring, hands-free communication mode starts with that door station.

K. Monitor:

1. If you press individual door station selector button, you can hear audio and if that door station has a camera, you can see image.

2. Press OFF button to end. Call also ends automatically when set communication end time is reached.

3. While door station is communicating with or monitored by a master station, you cannot monitor that door station from another master station.

4. If you press TALK button while monitoring, hands-free communication mode starts with that door station.

L. Scan Monitor:

1. When scan monitor button is pressed, door stations that have been enabled for "Scan Monitor" in programming can be monitored sequentially for a specified time interval (configured in programming).

2. Monitoring always initiates from target door station with lowest number.

3. If you press scan monitor button while individually monitoring target door station, monitoring starts with the next door station in line.

4. If you press scan monitor button while monitoring non-target door station, monitoring starts with the first door station enabled for scan monitoring.

5. Press OFF button to end.

6. Communication/video channel 2 is always used for scan monitoring. During scan monitoring, video signal is always outputted from video output port 2 (V2). Scan monitoring is not possible when communication/video channel 2 is being used, even if busy LED is not illuminated.

7. Only one master station at a time can perform scan monitoring.

8. If you press TALK button during scan monitoring, hands-free communication mode starts with that door station.

9. If you press individual door station selector button or scan monitor button during scan monitoring, monitoring switches to monitoring individual door station.

10. If master station receives call from door station during scan monitoring, scan monitor function ends automatically and shall be restarted manually.

11. Scan monitoring continues without limit until it is cancelled, but master station LCD monitor goes out after 10 minutes. Outside video output continues even with LCD off. If you press scan monitor button with LCD off, LCD lights up again.

12. If you press TALK button during scan monitoring, communication mode starts with door station being monitored.

M. Activating Door Release:

1. Press door release button during communication or monitoring with door station.
2. Door release function will be activated, releasing door lock.
3. You cannot operate door from outside telephone.
4. LED stays lit while door release function is activated.
5. Door release contacts can be set to Normally Open or Normally Closed via program configuration.

N. Priority:

1. Calls have priority based on the time the call was initiated. (Earlier call has priority over later call).
2. Communication Priority, from Highest to Lowest:
   a) Door station, telephone line communication.
   b) Priority All Call.
   c) Door station to master station communication.
   d) Master station to master station communication.
   e) Normal All Call.
   f) Monitor.
   g) Scan monitor.

2.3 SECURITY AND COMMUNICATION SYSTEM

A. Integrated Security and Communication System: Aiphone “AX Series”.

1. Power Source:
   a) 24 V DC, 2 A.
   b) Two PS-2420UL (110 V AC) per video system. One PS-2420UL (110 V AC) per audio system.
2. Door Station Calling:
   a) Tremolo call tone programmable from 10 to 600 seconds or infinite.
   b) LCD monitor remains on for duration of call-in and communication up to a maximum of 10 minutes.
3. Master Station Calling: Select station to call, pre-tone sounds, then speak hands-free or push-to-talk.
4. Communication:
   a) Auto: VOX.
   b) Manual: Press-to-talk, release-to-listen.
5. Camera: CCD 250,000 pixels.

6. Video Monitor:
   a) 3.5-inch direct view TFT color LCD.
   b) Scanning Lines: 525.
7. Door Release: N/O or N/C, programmable per station.
8. Door Release Contact: 24 V AC/DC, 0.5 A.
9. Wiring: CAT-5e UTP-4 homerun from each station to CEU.
10. Distance:
    a) Door Station to CEU: 980 feet maximum.
    b) Master Station to CEU: 980 feet maximum.
11. CO Line Transfer Adaptor: Viking Electronics, Inc. “K-1900-5 Hot-Line Pulse Dialer”.

B. Central Exchange Unit:

1. Central Exchange Unit: Model AX-084C.
   a) Connect: Maximum of 4 master stations and 8 door stations.
   b) Current Consumption:
      1) Video: 620 mA maximum.
      2) Audio: 650 mA maximum.
2. Video Output:
   a) NTSC standard 1 Vpp (0.7 to 1.4 Vpp).
   b) Two BNC.
3. Video Output Trigger:
   a) Open collector output.
   b) 24 V DC, 30 mA.
   c) Two RJ-45.
4. Master and door stations homerun to CEU for connection and programming.
5. RJ-45 Input Jacks: Station connection, add-on CEU connection, and CO line output.
6. Quick Release: Dry contact terminals for door release functions and power supply connection.
7. RS-232 Connection:
   a) Input: Programming.
   b) Output: Event logging and CCTV/access control interface. Software as specified in Access Control Section.
8. Composite video output (BNC).
9. Selective door release programmable to N/O or N/C.

10. CCTV and access integration.
11. Programmable by PC.
12. Rack mountable (2U).
13. Operating Temperature: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).
14. Power switch.
15. Power/Communications Error Display LED:
    a) Off: Power off.
    b) Lit: Power on.
    c) Flashing: Error in device or wiring.
16. Ports:
    a) Door station ports.
    b) Master station ports.
    c) Add-on exchange unit ports.
    d) CO line port.
    e) Setting/log port.
    f) Video output ports.
    g) Video output trigger ports.
    h) Door release relay ports.
    i) Power supply ports.

C. Master Stations:

1. Master Stations: Audio/Color Video Model AX-8MV
    a) CAT-5e homerun wired to CEU.
    b) Buttons:
        1) 8 individual door station selector buttons with LED.
        2) 8 individual master station selector buttons with LED.
        3) Door release button with LED.
        4) Scan monitor button with LED.
        5) CO line transfer button with LED.
        6) Privacy button with LED.
        7) Oversized TALK button with LED to activate VOX or PTT style communication.
        8) ALL CALL button.
        9) OFF button.

c) Occupied LED.

d) Speaker.

e) Microphone.

f) Volume Controls:

1) Receive Switch: Low, medium, high.

2) Transmit Switch: Low, medium, high.

3) Call tone.

g) LCD brightness control.

h) Jacks:

1) Headset receiver.

2) Headset microphone.

i) Headset Volume Controls:

1) Receiver.

2) Microphone.

j) Directory Cards and Covers:

1) Master station.

2) Door station.

k) Reset switch.

l) RJ-45 jack for connection to CEU.

m) Connector for add-on selector on master station.

n) Door call-in indicator.

o) Hands-free or push-to-talk communication.

p) All Call to master stations.

q) Scan monitoring.

r) Selective door release.

s) Privacy and mute functions.

t) Wall or desk mount. Metal bracket included for wall mounting.

u) Multi-Pin Connector:

1) Video output from master station.

2) External signaling of call tones (through IER-2 or activation of TAR-3).

3) Footswitch activation for TALK function.

v) Operating Temperature: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).

w) Monitor: 3.5-inch color LCD, master station Model AX-8MV.

x) Outside Video Output: NTSC standard 1 Vpp (0.7 to 1.4 Vpp), master station Model AX-8MV.

D. Door Stations:

1. Fixed Color Video Door Station: Model AX-DV.

a) Faceplate: Aluminum die cast.

b) Surface mount.

c) Call Button: Metal.

d) Camera.

e) Camera Protection: Clear Lexan lens cover.

f) RJ-45 jack.

g) Speaker.

h) Microphone.

i) Directory card.

j) White Illumination LEDs: Automatically turn on in low-light conditions.

k) CAT-5e homerun wired to CEU.

l) Operating Temperature: 14 degrees F to 140 degrees F (minus 10 degrees C to 60 degrees C).

m) Vandal resistant.

3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install in accordance with requirements of Section 270500 and per manufacturer’s recommendations.

2. Complete installation shall be in accordance with the cable television company's rules and regulations.

B. Wiring:

1. Observe standard Ethernet wiring practices in accordance with section 271000.

2. Do not splice cables between terminating points.

C. Grounding: Install television system grounding and bonding in accordance with the latest edition of NEC, Article 820, and the requirements contained in specification section 270526.

D. Wiring Methods:

1. The entire installation shall be concealed in the construction except that it may be run exposed in unfinished areas and telecom/electrical rooms. Obtain prior approval from Architect/Owner for exposed portions of installation.
2. Throughout the building corridors and common areas, cables shall be installed within cable tray system located concealed above the suspended ceiling. Refer to specification section 260536 for details. Where the cable exits the cable tray, it shall be supported by j-hooks.
3. Cabling/conduit shall NOT be installed underground without engineer's approval. All cabling installed below grade shall have a moisture resistant jacket.
4. All cabling installed in return air plenums shall be plenum rated.
5. Above suspended ceilings or in other non-exposed areas, install cables within J-hooks (sized as required). Fasteners shall be placed at random intervals no greater than 60 inches and preferably on 48 inch centers. Cable sag between supports shall not exceed 8 inches.
6. Where wiring enters or travels through walls, floors, etc., or is subject to physical damage, it shall be installed in metallic conduit.
7. Avoid penetration of fire rated walls, ceilings, etc. Where this is not feasible, reseal penetrations (including those in sleeves) with an Underwriter's Laboratories (UL) approved sealant material. Seal all floor, ceiling, and wall penetrations in the wiring closets. For new installations through fire rated walls, provide *Flamestopper* thru wall fitting as manufactured by Wiremold (size as required for each location).
8. Provide minimum 2" sized metallic conduit sleeves above ceilings between non-rated corridors and areas where data outlets are located, and elsewhere where required to install cabling. Provide adequate quantity of sleeves required for all cables.
9. Where an outlet is surface mounted, surface raceway shall be used to cover the cable.
10. The fill shall not exceed 40 percent for cable pathways (raceways, cable trays, j-hooks, sleeves, etc.).
11. Cables and associated hardware shall be placed so as to make efficient use of available space in coordination with other trades and uses. All cables and associated hardware shall be placed so as not to impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).
12. Cables shall be supported in with appropriate cable supports. Cables shall not be fastened to or supported from any other building system (for example: electric conduits, sprinkler lines, ductwork, etc.). Cabling shall not rest on suspended ceilings, be fastened to ceiling support wires, or be installed near steam piping or over light fixtures.
13. Cables shall be routed to avoid light fixtures (18 inches minimum spacing), sources of heat (12 inches minimum spacing), and power cables or conduits (16 inches minimum spacing unless cables are installed in shielded trays or approved

conduits). Cables must be spaced a minimum 120 inches (10 feet) from bus duct.

14. Cables must be handled with care during installation so as not to change performance specifications. The Contractor shall not over tighten tie wraps or over bend the cable. Creased or kinked cables will not be accepted and will be replaced at the Contractor's expense.

15. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

E. Labels:

1. The labeling plan shall be developed by the Contractor and approved by Owner/Engineer. The Contractor will label all outlets following the detailed shop drawing design, using permanent/legible typed or machine engraved labels

2. The labels on station terminals shall be numerically sequential. Outlets shall be labeled to match the labels on the corresponding terminal position.

3. A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

4. Labels shall correspond to as-built and to final test reports.

5. Labels are to be mechanically generated. Handwritten labels are not acceptable.

3.2 TESTS

A. Upon completion of installation, test performance of system and provide written report of test results.

3.3 FIELD ADJUSTMENTS

A. Replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings and sheath removed too far.

B. Perform field adjustments to obtain proper functioning as required to place the equipment in final operating condition in accordance with the contract documents.

C. Necessary field adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the owner.

3.4 TRAINING

A. Upon the completion of all work and tests, furnish the services of a qualified factory-trained technician to provide operating instructions of all systems and equipment for a minimum period of one (1) eight hour (8 hr) day. Notify in writing through the Architect, Construction Manager, and the Owner of the time and date the first demonstration will take place. Conduct a walking tour of the system.

B. During this period, instruction will be given to the owner or his representative(s) in the full operation, adjustment and maintenance of all equipment furnished or provided.

C. Programming: Review all system programming with the owner's representative and the engineer, and obtain written approval before system is put on line. Telephone service interface shall be arranged by the owner.

D. Subsequent to hookups of equipment, test the entire system and demonstrate proper functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

SECTION 281613 – INTRUSION DETECTION SYSTEMS

1 GENERAL

1.1 SECTION INCLUDES

A. Performance of all labor and providing and installing all materials, components and accessories as required for the construction of the project as indicated by contract documents.

B. Equipment specified in this section includes but is not limited to the following:

1. Control/Communicator (Security Control Panel)
2. Control Station (Key Pad)
3. Accessories.

1.2 WORK INCLUDED

A. Provide all labor, materials, equipment, and services to perform all operations required for the complete installation and related work as shown in all contract documents.

B. All wiring for this system shall be installed within metallic conduit.

1.3 QUALIFICATIONS

A. The alarm contractor shall provide all equipment and accessories for a complete electrically supervised security alarm system as described herein and shown in the drawings.

B. Model numbers and designations, which appear herein, indicate design, quality, and type of material as well as operating characteristics.

C. The security alarm system products shall be built modular in construction for ease of expansion and service. Functions shall be on replaceable panels or modules to accommodate functional changes when required. All critical wiring and connectors shall be supervised so as to give a trouble signal if removed or disconnected.

1.4 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 260500 and General Conditions of Contract:

1. Product Data
2. Outline and Layout Drawings
3. System Wiring Drawings and Diagrams

B. Provide complete submittals, which shall include floor plan drawings indicating device locations, schematic wiring drawings, outline drawing of control console, and spec sheets for all equipment. Partial submittals will not be accepted.

C. If re-submittals are required, they shall be provided within two (2) weeks after the date of notification. If re-submittals are not received by the Engineer in two (2) weeks, the supplier will be considered nonresponsive and subsequent submittals from the supplier will not be reviewed. The Contractor shall then provide submittals from another equipment supplier within two (2) weeks as directed by the owner at no change in contract price.

D. The cost of review of any submittals after two (2) submittals have been rejected shall be paid by the Contractor to the Engineer. Prior to re-submittal, purchase order shall be delivered to the Engineer before additional reviews of submittal start.

1.5 RECORD DOCUMENTS

A. The As-Built drawings shall include three (3) complete sets of 30" x 42" contract base sheet drawings with any and all changes included and noted. The As-Built drawings shall be kept up to date continuously by the electrician in charge of the system installation. These drawings shall be reviewed on a weekly basis for accuracy and completeness.

B. The Operation and Maintenance Manual shall include a complete set of equipment, component and device specification and data sheets as well as a reduced size paper copy (11 x 17) of the complete set of system drawings described in specification section 1.5 A. The manual shall be bound in a black three ring loose leaf binder with dividers and a table of contents. Three (3) duplicate sets are required.

C. Five (5) sets of keys to all locks shall be provided in a proper key box or binder with each set of keys properly and legibly marked and tagged. Loose keys will not be accepted.

D. All documents and items described above shall be submitted for approval and turnover prior to the final testing and acceptance of system.

1.6 ACCEPTANCE OF SYSTEM

A. Final acceptance of the system will only be made after the required tests, complete record document package and the instruction period have been provided.

1.7 GUARANTEE

A. Guarantee all labor, materials and equipment provided under this contract against system defects for a period of one (1) year after the date of final acceptance of this work by the Owner.

B. Special Project Warranty: Submit a written warranty, executed by the contractor, installer, and the manufacturer, agreeing to repair or replace equipment which fails in material or workmanship within the specified warranty period. This warranty shall be in addition to and not a limitation of other rights the owner may have against the contractor under the contract documents.

C. Warranty of Conformance with Specifications: The contractor shall warrant that all specified functions shall be provided even if functional omission is not discovered until

the end of the warranty period. This shall warranty full function of the system even if the owner does not fully utilize the capabilities of the system initially.

1.8 SYSTEM DESCRIPTION

A. The actuation of any alarm initiating device shall cause the following to happen:

1. Alarm sirens shall sound on any intrusion alarm activation.

2. Centrally located visual annunciation shall take place at a control station showing the particular point in alarm.

B. A code (personal identification number) shall be provided through the control station to manually silence all audible alarm signals.

C. The control/communicator (security alarm panel) shall contain initiating and bypass circuits as required, and shall be connected to all necessary equipment to individually and collectively power and effect the operating of the overall security alarm system. All initiating circuits shall be supervised. The control station shall visually annunciate alarm and trouble conditions.

D. Activation of any installed control station shall allow designated personnel an installer adjustable pre-set entry/exit delay time interval to enter or exit a secured area before alarming the system.

E. The control/communicator shall be connected to a primary source of 120 volts, 60 Hz, through a U.L. Listed 18.0 VAC transformer rated at 50 VA. The control/communicator, in turn, shall then provide up to 2.5 A of power at 12.0 VDC nominal for the security alarm system's supervisory and detection functions.

F. Sufficient standby power shall be furnished for no less than four hours of overall system operation at full auxiliary power standby load of 1.5 A and 2.5 A total in alarm.

G. The alarm vendor shall provide all power supplies, peripheral devices, and equipment required for a complete and operational security alarm system.

H. The security alarm system shall provide all the necessary hardware and software to interface with the intercom system to provide an audible alarm signal over the intercom system speakers upon security alarm activation.

2 PRODUCTS

2.1 MANUFACTURERS

A. The intrusion detection system is specified as Bosch Security as provided by Siemens Industry, Inc.

B. Manufacturers submitted by the bidder as equals (or substitutions) to the basis of design shall comply with the requirements for substitutions in specification Section 260500, and the following:

1. The equipment to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in

this specification will only be considered when the following requirements have been met:

a) A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by the Engineer, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

b) The supplier shall furnish evidence that the proposed or alternate system performance is equal or superior to the system operation stated in the specification. Such evidence shall be submitted to and accepted by the Engineer, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

c) The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written, and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point by point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

d) The acceptability of any alternate proposed system shall be the sole decision of the Engineer.

2.2 CONTROL/COMMUNICATOR (Security Control Panel)

A. Intrusion Detection System (IDS) control Panel shall be a Bosch D7412GV4.

B. System shall accommodate up to 99 user codes, arm/disarm.

C. System shall be able to supervise up to 8 Alarm Command Centers.

D. System shall have 8 individually programmable alarm partitions.

E. System shall be expandable to 75 zones/addressable points.

2.3 CONTROL STATION (Keypad)

A. Arm/Disarm keypads shall be Bosch D1260 alpha-numeric alarm command centers

B. The control station shall contain a keypad, sounder, and status indicator lights armed, status, and power LED’s with an alpha read-out display.

C. The control station shall have a back-lit keypad backlight dimmer, and volume control. Text for alpha numeric displays shall be freely programmable for all points and partitions.

D. A control station shall support all of the control/communicator functions.

E. A or all of the control stations shall be capable of being a master control station. It shall be capable of accessing all partitions. It shall display the arm/disarm status of all the partitions and can be used to individually control each partition. It shall be able to be assigned to any or all of the partitions.

F. The control station shall be connected to the control/communicator with #22 AWG, unshielded, 4-wire cable and have a maximum of 1000 feet between the control/communicator and the control station.

G. The control station shall be capable of complete system programming by inputting an installer changeable personal identification number.

H. The control station shall allow the following four levels of arming:

1. The entire system shall be armed with exit points programmed for delays.
2. The entire system shall be armed with entry and exit points programmed for delays.
3. The perimeter points shall be armed without delays and the interior points shall not be armed.
4. The perimeter points shall be armed and programmed for entry and exit delays and the interior points shall not arm.

I. Arming and disarming the security alarm system shall be done by entering a user personal identification number.

J. Arming the alarm security system shall initiate a programmable 0-99 second exit delay on points programmed for delays. The red ‘armed’ light shall flash, then go on steady after the exit delay has been completed.

K. Entering a protected area through a delay point, when the system is armed, shall initiate a 0-99 second entry delay, and the pre-alert tone shall sound. Disarming the system before the entry delay expires shall silence the pre-alert tone.

L. Entering a protected area through a delay point, when the system is armed, and an alarm had occurred while the system was armed, the red ‘armed’ light shall flash during the entry delay. Entering a personal identification number shall disarm the system and shall stop the light from flashing.

M. there shall be a mode to custom arm the system. This mode shall be able to be programmed to arm any combination of point functions.

N. Bypassing points or force arming the security alarm system shall be done at the control station when the green ‘status’ light is off, indicating one or more points are not ready to arm.

O. The following tests shall be able to be performed by inputting a key command at the control station while in the disarm mode:

P. A point test shall begin scrolling the point numbers of those points that are untested (unviolated). While a point is being tested (violated) it will appear on the control station display and the sounder will turn on. When that point is done being tested, the sounder will turn off and the display will return to showing those points remaining to be tested.

Q. the local battery/sounder test shall operate the control station sounders alarm outputs for two seconds while load testing the battery.

R. The battery test shall check the battery voltage while the full system or alarm load is applied.

S. The communicator test shall initiate the control/communicator to send a pre-programmed report to a digital receiver.

T. The control station shall be capable of surface mounting and recess mounting. It shall be capable of being mounted to single or four gang switch or outlet boxes.

U. The control station shall include six function buttons to facilitate common system commands. These buttons shall be labeled ON to arm the system, OFF to disarm the system, PERIMETER ONLY, to arm only the perimeter, NO ENTRY to disable the entry delay period, and BYPASS, to disable a point.

V. A keypad with eight zone LED's shall also be available. This keypad will not include the alpha numeric displays and will include four additional system status LED's plus an LED to annunciate the status of each of the first eight points.

2.4 IDS MOTION DETECTORS

A. Ceiling mount motion detectors shall be Bosch Model DS938Z with 360 degree, 60' coverage.

B. Wall mount motion detectors shall be Bosch Model DS794Z with 80' coverage.

C. Motion Detectors shall be WHITE.

2.5 REQUEST TO EXIT SENSOR

A. Request to exit devices shall be provided under this specification.

B. Request to exit devices shall be high performance motion sensors.

C. Request to exit devices shall have pointable coverage. With a mounting height of 7-1/2" feet, the coverage shal be 8' x 10'.

D. Request to exit devices shall have up to 64 seconds of adjustable latch time.

E. Request to exit devices shall have selectable fail safe/fail secure modes.

F. Acceptable manufacturer: Bosch DS160.

G. Device shall be WHITE.

3 EXECUTION

3.1 INSTALLATION

A. Installation shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of work.

B. Install all wiring in accordance with manufacturer's and U.L. recommendations.

C. All wiring shall be stranded copper and installed in EMT conduit as a separate and segregated system.

D. Provide #18 AWG four conductor cable as recommended by the equipment supplier.

E. Provide a dedicated 120 volt circuit in separate conduit as a source of primary power for the master control/communicator.

F. Supply, install, and wire recommended transformers and DC power sources to the master control/communicator. The transformer shall not be shared with anything else.

G. Perform walk tests and set-up procedures for each detector as specified by the manufacturer to ensure that all boundaries of coverage are sufficient to detect intruders in each secured area.

H. The alarm contractor shall provide complete wiring diagrams to the electrical contractor as part of the shop drawing submittal, and shall supervise the installation in order to ensure a complete operating and trouble-free system.

I. Provide 5 sets of keys for all panels, stations, and devices.

J. Install system in accordance with system manufacturer's instructions. Furnish and install all equipment necessary for a complete and operable system. Final connections between equipment and the wiring system, testing and placing system in operation, shall be completed under direct supervision of a representative of the manufacturer. Submit manufacturer's printed installation instruction with operation and maintenance data at completion of Work.

K. Contractor and manufacturer shall correct any condition producing cross talk, appreciable loss of volume, or distortion in the system after installation has been completed.

3.2 MOUNTING HEIGHTS

A. Unless noted, security system components shall be mounted at the following heights:

1. Arm/Disarm Panel: 40 inches above finished floor.
2. Motion Detection – per manufacturers requirements.

3.3 TESTING

A. The alarm contractor shall submit a written test report that the system has been 100 percent tested and approved. The final test shall be witnessed by the owner's

representative and performed by the alarm vendor. The final test report must be received and acknowledged by the owner prior to request for final payment.

B. Provide instruction to the owner's satisfaction with regard to proper use and operation of the system.

3.4 WARRANTY

A. The entire system shall be warranted against failure and installation defects for a period of one (1) year from the date of the acknowledged owner acceptance of the final test.

END OF SECTION

1 SECTION 282313 – VIDEO SURVEILLANCE SYSTEMS

2 GENERAL

2.1 SUMMARY

A. Section Includes:

1. Digital Video Surveillance (Closed Circuit Television (CCTV)) System; complete, including all wiring, cables, raceways, terminal cabinets, pull boxes, outlet and mounting boxes, cameras, digital video recorders, multiplexers, power supplies, software, mounting hardware, testing, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.

2.2 QUALITY ASSURANCE

A. General:

1. All equipment and software provided shall be standard components that are regularly manufactured and utilized in the manufacturer's system.
2. All systems and components shall have been thoroughly tested and proven in actual use.
3. All systems and components shall be provided with the availability of technical support from the manufacturer during normal business hours at no charge.

B. Installer Qualifications: An experienced installer who is an authorized representative of the manufacturer for both installation and maintenance of the system required for this Project.

C. Manufacturer's Representative: The system shall be provided and commissioned by the authorized Manufacturer's Local Representative. This representative shall provide documentation that the organization is factory certified on the system. This organization must maintain a qualified technical staff to program and service the system. Upon request, include the names and locations of at least five such installations within one hundred miles of the project, and furnish documentation that the system has performed satisfactorily for the proceeding 48 months.

D. Design and operation of the system shall conform to the following referenced codes, regulations, and standards as applicable:

1. National Electrical Code (NEC)
2. UL 294, UL864 and UL 1076
3. FCC Rules and Regulations - Part 15 (Radio Frequency Devices)
4. NEMA - Section 250 (Enclosures for Electrical Equipment)

5. All applicable Federal, State and Local laws, regulations and codes.

2.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 280500 and General Conditions of Contract:

B. Provide complete submittals, which shall include schematic wiring drawings and specification sheets for all equipment. Partial submittals will not be accepted.

C. If re-submittals are required, they shall be provided within two (2) weeks after the date of notification. If re-submittals are not received by the Engineer in two (2) weeks, the supplier will be considered nonresponsive and subsequent submittals from the supplier will not be reviewed. The Contractor shall then provide submittals from another equipment supplier within two (2) weeks as directed by the owner at no change in contract price.

D. The cost of review of any submittals after two (2) submittals have been rejected shall be paid by the Contractor to the Engineer. Prior to re-submittal, purchase order shall be delivered to the Engineer before additional reviews of submittal start.

2.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 280500 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Recommended renewal parts list
3. Final as-built drawings
4. Complete Wiring diagrams

2.5 RECORD DOCUMENTS

A. The As-Built drawings shall include three (3) complete sets of 30" x 42" contract base sheet drawings with any and all changes included and noted. The As-Built drawings shall be kept up to date continuously by the electrician in charge of the system installation. These drawings shall be reviewed on a weekly basis for accuracy and completeness.

B. The Operation and Maintenance Manual shall include a complete set of equipment, component and device specification and data sheets, and the name and address of the installer. The manual shall be bound in a black three-ring loose leaf binder with dividers and a table of contents. Three (3) duplicate sets are required.

C. All documents and items described above shall be submitted for approval and turnover prior to the final system testing. Three (3) duplicate sets of the Test Report shall be submitted to the Engineer.

2.6 ACCEPTANCE OF SYSTEM

A. Total acceptance of the system will only be made after the required tests, complete record document package, and the instruction period have been provided.

2.7 GUARANTEE

A. Guarantee all labor, materials and equipment provided under this Section against system defects for a period of one (1) year after the date of final acceptance of this work by the Owner.

3 PRODUCTS

3.1 MANUFACTURERS

A. The basis of design Digital Video Recorders and Cameras shall be manufactured by:

1. American Dynamics

B. Manufacturers submitted by the bidder as equals (or substitutions) to the basis of design shall comply with the requirements for substitutions in specification Section 260500, and the following:

1. The equipment to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

a) A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by the Engineer, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

b) The supplier shall furnish evidence that the proposed or alternate system performance is equal or superior to the system operation stated in the specification. Such evidence shall be submitted to and accepted by the Engineer, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

c) The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written, and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point by point

statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

d) The acceptability of any alternate proposed system shall be the sole decision of the Engineer.

3.2 SYSTEM DESCRIPTION

A. The intent of these specifications is to provide a complete Digital Video Surveillance (Closed Circuit Television (CCTV)) System with the following features and capabilities:

1. IP Cameras
2. Network Video Recorders (NVRs)
3. External Storage
4. Unified Security Monitoring / Management Software Applications
5. Integrations to External Systems (e.g., Access Control, Video Analytics, etc)
6. Video and Event SDK / API (for development of new integrations)
7. Failover / Redundancy Solution
8. The Network Video Recorder shall be a software-based, open platform solution that functions as an appliance server and operates on hardened and embedded Linux® operating system. It shall be available as a bundled server solution.

3.3 DIGITAL VIDEO RECORDER

A. The Network Video Recorder shall be a software-based, open platform solution that functions as an appliance server and operates on a hardened and embedded Linux operating system. It shall be available as a bundled server solution. The unit must operate in server-client architecture as a network appliance and simultaneously support viewing, recording, and playback of video.

B. The Network Video Recorder shall provide required functionality in the following areas:

1. System Performance -
2. Initial Installation / Configuration
3. Video Recording, Live Viewing & Playback
4. Audio Recording, Live Viewing & Playback
5. Video Search & Export
6. Event or Alarm Generation / Management
7. External Storage – 3 Terabyte
8. Supported IP Cameras & Peripheral Devices
9. Web Client

10. Maintenance / Software Upgrades
11. Integrations
12. IT Requirements / Networking
13. SDK

C. System Performance

1. While operators are actively using the system and accessing the live and recorded video/audio, a single ADVED02N0N4A desktop network video recorder shall support any combination of supported IP cameras or encoders that meet both of the following criteria:
2. Maximum aggregate throughput of 100Mbit/s on recorded video streams
3. An example configuration could be 32 cameras at H.264 resolution, H.264 encoding, 30 FPS, with medium scene activity and motion detection on all streams
4. Maximum of 32 cameras connected to a single server
5. The ADVED02N0N4A 's maximum aggregate throughput of 400Mbit/s shall be supported both when writing to internal server hard disks and to external storage over iSCSi or Fiber connections. Manufacturer shall provide, on request, documented test results demonstrating this performance.
6. While recording up to 200Mbit/s the ADVED02N0N4A Network Video Recorder shall simultaneously support delivery of up to 100Mbps of video playback streams with no impact to recording or alerts.
7. The Network Video Recorder bundled server ADVED02N0N4A shall support up to 4 TB of internal video storage.
8. The OptiPlex XE will support a maximum throughput of 50Mbps.
9. The Network Video Recorder shall allow the completion of motion searches on any camera without reducing the aggregate recorded throughput or impacting recording or event management.
10. The Network Video Recorder shall support the completion of a motion search over 1 week of recorded video of a scene containing an average level of motion throughout, regardless of codec or resolution of the recorded video, within 2 minutes.
11. The Network Video Recorder shall synchronize audio and video streams and maintain synchronization to within ½ a second.

D. Initial Installation / Configuration

1. The Network Video Recorder shall allow for auto-discovery of all supported IP cameras or encoders on the network

2. The Network Video Recorder's operating system and application must be installed on a dedicated hard drive, separate from the hard drives used for video recording, to dramatically reduce the risk of system failure.

E. Video Recording / Live Viewing / Playback

1. The Network Video Recorder shall be able to stream live video to connected clients.
2. The Network Video Recorder shall be able to stream recorded video (instant playback) to connected clients.
3. The Network Video Recorder shall be able to support streaming recorded video content at the following rates:
   a) Fast Forward x4
   b) Fast Forward x3
   c) Fast Forward x2
   d) Clock Speed (x1)
   e) Frame Forwards
   f) Frame Backwards
   g) Clock Speed Rewind (x1)
   h) Fast Rewind x2
   i) Fast Rewind x3
   j) Fast Rewind x4
4. The Network Video Recorder software shall support recording video in the following formats:
   a) Motion JPEG (MJPEG) video codec
   b) MPEG-4 video codec
   c) H.264 video codec
5. The Network Video Recorder software shall allow the user to create and edit video recording schedules for each connected camera in sixty minute increments. Recording schedules shall be configurable by day-of-week or hour-of-day.
6. The Network Video Recorder software shall allow camera-by-camera configuration of the following recording modes:
   a) No Recording,
   b) Continuous Recording,
   c) Alert-Based Recording
   d) Continuous with Alert-based Recording

7. The Network Video Recorder software shall support the configuration of the following video parameters for each available stream on connected cameras or encoders:
   a) Codec
   b) Frame Rate
   c) Resolution
   d) Quality

F. Audio Recording / Live Listening / Playback

1. The Network Video Recorder shall support recording and re-broadcasting of audio inputs connected to the audio channel on supported IP cameras and encoders.
2. The Network Video Recorder shall be able to stream live audio to connected clients
3. The Network Video Recorder shall be able to stream recorded audio to connected clients
4. The Network Video Recorder software shall support recording audio in the following formats:
   a) AAC audio codec
   b) G.711 audio codec
   c) G.726 audio codec

G. Video Search & Export

1. The Network Video Recorder shall support the configuration of both Date / Time and Motion searches via the NVR Web Client.
2. The Network Video Recorder shall support the configuration of both Date / Time and Motion searches via connected Security Management Client applications.
3. To enable fast motion-based video searches over days, weeks or months of video, the Network Video Recorder shall support integrated motion-detection video analytics on supported cameras.
4. The integrated motion-detection video analytics shall support the configuration of the following rules:
   a) Motion-detection anywhere in scene
   b) Motion-detection within user-defined region-of-interest
   c) Motion-detection outside of user-defined region-of-interest
5. Integrated motion-detection video analytics shall have the ability to capture and store in an industry standard database, motion activity events on every frame of video from every camera.

6. Integrated motion-detection video analytics shall have the ability to be enabled / disabled on each connected camera.

7. The Network Video Recorder shall support integrated motion-detection video analytics on MJPEG or MPEG-4 video streams.

8. Integrated motion-detection video analytics shall be supported on H.264 cameras that can also produce an MJPEG stream.

9. The Network Video Recorder shall allow the user to export clips of video from one or multiple connected cameras.

10. The Network Video Recorder shall provide the user the ability to export video clips in their native format (ISO) which can be played using the client player application.

11. The SMS shall support exporting “tamper-protected” video clips using check-sum authentication.

H. Event or Alarm Management

1. The Network Video Recorder shall allow for the following alarm recording settings:

   a) Codec

   b) Maximum Video Frame Rate (FPS)

   c) Resolution

   d) Quality

   e) Pre-Alarm Duration – (Selectable from 30 to 300 seconds)

   f) Post-Alarm Duration – (Selectable from 30 to 300 seconds)

2. The Network Video Recorder software shall support the generation of the following alarm events:

   a) Motion Detection

   b) Dry Contact

   c) Video Lost

   d) Video Restored

   e) Unit Status Changed – Normal or Reboot

   f) Unit Protection Status Changed – None, Monitor or Failover

   g) Unit Storage Status Changed – Normal, Degraded, Backup or Missing

   h) Camera Status Notification – Add, Remove, Video Loss or Normal

   i) The Network Video Recorder shall support the configuration of Motion Detection alarms with multiple independent regions-of-interest on each camera.

3.4 REMOTE EYES VIDEO MONITORING STATION SOFTWARE

A. The video monitoring station software shall provide the operator with the ability to remote view, control, and administer a network of up to 240 cameras on 15 servers at multiple remote properties. Remote viewing capabilities shall allow the operator to easily change the view from one property to the next using a standard computer mouse and shall be capable of displaying remote camera images in various layouts including full-screen, a 4X4 matrix of 16 cameras, and 32 cameras arranged on either 2 or 4 monitors. The remote viewing capabilities shall include multiple persistent composite layout screens such that the operator can select cameras from multiple properties for concurrent display on a single screen. The video monitoring station shall allow the operator the ability to dynamically select a remote PTZ camera for control using a mouse or a joystick and subsequently relinquish control to other users. The video monitoring station shall allow the operator to view directories of stored video archives on remote DVRs and selectively choose to retrieve and play back certain video images. The video monitoring station shall provide the operator with an address book directory of all remotely addressable DVRs, including their IP addresses and log on information for auto-connect. The video monitoring station shall allow the operator to remotely administer a DVR as if he were physically present at the unit. The design objective of the video monitoring station is to allow complete centralization of viewing and administration of dozens or hundreds of remote network addressable DVRs, thereby allowing completely unattended operation of the DVR units.

B. The video monitoring station software shall meet or exceed the following design and performance specifications:

1. The monitoring station shall support up to 15 simultaneous connections to Remote Eyes DVRs viewing up to 240 remote cameras. Multiple monitoring stations can co-exist on the same network with shared access to the remote DVR units, thereby allowing scaling of the monitoring station to support an unlimited number of DVRs and cameras.

2. The monitoring station shall be compatible with Windows 2000 or XP Pro software.

3. The monitoring station shall support IP network protocols and be capable of viewing, control, and administering any IP addressable Remote Eyes DVR.

4. The monitoring station shall be capable of maintaining a connection to a remote DVR for an indefinite time period.

5. The monitoring station shall allow the operator to view live images from up to 32 cameras simultaneously arranged on either 2 or 4 monitors and refreshing at a rate of up to 4fps per camera.

6. The monitoring station shall provide the operator with an easy method for switching his view from one DVR to the next.

7. The monitoring station shall provide the operator with an easy method for moving cameras from multiple DVRs onto a single composite viewing screen for live monitoring of cameras from multiple properties concurrently. Such

composite viewing screens shall be stored independently on the monitoring station so that the user can easily navigate from one composite layout to the next. An indefinite number of such composite layouts can be defined by the user.

8. The monitoring station shall support a variety of camera display layout matrices, ranging from full screen view of a single camera to a 4X4 matrix of 16 cameras or 32 cameras arranged on either 2 or 4 monitors.

9. The monitoring station shall provide a full-screen mode such that the entire display is used by the cameras.

10. The monitoring station shall provide the operator with an editable address book listing available servers and their IP addresses. The operator shall be able to store his logon ID and password for each server once and then be capable of auto-connecting to his servers.

11. The monitoring station shall include a camera sweep mode that automatically cycles through all addressable cameras for viewing.

12. The monitoring station shall automatically detect remote motion or alarm events and provide the operator with either a visual or audio cue that an event has occurred that requires monitoring.

13. The monitoring station shall have the capability to provide the operator with a two-way audio signal whereby the operator can listen to events occurring at a remote DVR and also speak to individuals near the remote DVR.

14. The monitoring station shall allow the operator to instantaneously select a live camera image for printing.

15. The monitoring station shall allow the operator to select a remote camera for control (including PTZ cameras), control the camera using a mouse or joystick, and subsequently relinquish control.

16. The monitoring station shall allow the operator to search a remote DVR for relevant video by previewing the first frame of each clip or by reviewing the full motion clip remotely using video streaming at speeds up to 30fps.

17. The monitoring station shall allow the operator to retrieve a list of stored video images from a remote DVR. The operator can then download at high speeds select video images from the list and play them back at the monitoring station. The monitoring station can store retrieved video clips locally for subsequent review or for copying to removable media.

18. The monitoring station allows video image playback at normal speed, fast speed, forward, reverse, and single step. Video images are automatically played back serially.

19. The monitoring station shall provide the ability to remotely adjust camera setting including brightness and focus. The monitoring station shall allow PTZ patterns and preset positions to be remotely defined and then run automatically or on demand.

20. The basis of design monitoring station software shall be the following Remote Eyes part number:

    REMVCLIENT Remote Eyes Multi-View Client v3.0 (one seat)

3.5 IP DOME CAMERAS

A. Manufactures: Subject to compliance with requirements, provide products by:

1. American Dynamics Illustra 400 Series or approved equal.

    a) Camera shall have a white housing and clear lens.

B. Provide required quantities of indoor video surveillance camera systems. The package shall contain a standard resolution, high sensitivity color indoor camera. The package shall be available with a vari-focal lens. The camera/lens assembly shall be installed in a vandal resistant indoor dome housing.

1. The camera shall utilize the Sony IMX035 CMOS sensor.
2. The minidome and bullet cameras shall have an integrated 3.3-12mm IR corrected varifocal lens.
3. The camera shall have a dome enclosure complying with IP66 weatherproofing standards.
4. The camera shall dome chassis shall be vandal resistant constructed of aluminum with a polycarbonate dome bubble (illustra 400 outdoor fixed dome and bullet only).
5. The camera shall have a 3-axis gimbal with 360° pan 90° tilt and 180° Z-rotation for easy and accurate positioning.
6. The camera shall be surface mountable with optional pendant mount or wall mount.
7. The camera shall be H.264 (MPEG4, Part 10) compliant.
8. The camera shall have dual standard compression support with simultaneous streaming of both H.264 and MJPEG formats.
9. The camera shall have multi-streaming support of up to 8 non-identical concurrent streams (different frame rate, bit rate, resolution, quality and compression format).
10. The camera’s bit rate control shall be selectable between constant bit rate and variable constrained variable bit rate.
11. The camera shall have Real Time Streaming Protocol (RTSP) support allowing for compatibility with media players such as Windows Media Player, Apple QuickTime, VLC Player and others.
12. The camera shall output at a maximum resolution of 896(H) x 720(V) pixels at a maximum frame rate of 30 frames per second (FPS).

13. It shall be possible to program the camera to output a variety of lower resolution images, i.e., CIF and D1 30 FPS.
14. The camera shall provide 5 level settings for quality of H.264 compression.
15. The camera shall support a HTTP and RTSP/RTP network protocols.
16. The cameras shall feature motion detection with a minimum of 500 independent detection zones.
17. The camera shall feature automatic exposure, automatic white balance, shutter speed control, 50/60Hz selectable flicker control, programmable brightness, saturation, gamma, sharpness, windowing and decimation, simultaneous delivery of full-field view.
18. The camera shall incorporate necessary algorithms and circuits to detect motion in low light with clarity.
19. The camera shall support a minimum illumination of 0.2 Lux @ F1.2 in color mode.
20. The camera shall support an IR sensitive minimum illumination of 0.01 Lux in B/W mode.
21. The camera's primary power source shall be Power over Ethernet (PoE) complying with the IEEE 802.3af standard.
22. The camera shall have IR illuminators capable of illumination up to 54 feet powered by PoE (802.3af).
23. The camera shall have the alternative option to be powered from between a 12V DC or 24V AC power source providing at least 5W of power.
24. The camera's operating ambient temperature shall be -40°C (-40°F) to 50ºC (122ºF) for warm start conditions (for outdoor fixed dome and bullet models).
25. The camera shall be FCC Part 15, Class A and CE compliant.
26. The camera shall have the ability to directly export snapshot images in JPEG form and video clips via email, FTP, Network storage and on board SDHC card.
27. The camera shall be able to store and utilize the user name and password of the SMTP server to enable protected email export.
28. The camera shall be able to record to an SDHC card based on motion detection, alarm input, or on schedule managed via the camera's web-based GUI.
29. The camera shall be able to record to a SDHC card in a circular fashion.
30. Recorded video on the cameras SDHC card shall be accessible via the cameras web browser GUI.
31. The camera shall have the capability to provide at least 3 independent privacy zones.
32. The camera shall have 48MB of buffer storage for pre and post alarm capture.

33. The camera shall have at least one alarm output and one alarm input.

34. The camera shall have a Linux based operating system.

35. The camera shall have RSA-based public key cryptography with a 1024 bit private key length.

36. The camera shall support bi-directional audio in half and full duplex.

37. The camera shall support wide dynamic range up to 100dB with 9 quality settings.

3.6 CABLES, WIRES, AND MISCELLANEOUS ACCESSORIES

A. Comply with requirements in Division 26 Section “Raceway and Boxes for Electrical Systems.”

B. B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer’s limitations on bending radii. Provide and use lacing bars and distribution spools.

C. For LAN connection copper communication wiring, comply with Division 27 Section “Voice and Data Communications Cabling”.

D. Provide sufficient quantities of unshielded twisted pair (UTP) cable for Plenum rated low voltage camera power, and control systems required for a complete and fully functional system. UTP cable shall meet the following specifications: 18 or 16 AWG copper conductor (confirm exact size and type with manufacturers recommendations), 300 volt insulation, rated 200 degrees C, paired conductors twisted together and covered with a nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.

E. Provide all necessary parts and accessories, including but not limited to adapters, connectors, plugs, transformers, switches, relays, lamps, splitters, and power supplies required to guarantee a complete and fully functional closed circuit video surveillance system within this facility.

4 EXECUTION

4.1 INSTALLATION

A. Install in accordance with requirements of Section 280500 and manufacturer's recommendations.

B. All wiring shall be installed in conduit except as otherwise noted.

C. CAMERA INSTALLATION

1. Install cameras centered in ceiling tiles.

2. Install cameras level and plumb

3. Power cameras through PoE in all cases. Locate network jack near camera in concealed location and make final connection to the camera by patch cable.

4.2 TESTS

A. Prior to the acceptance test of the project by the Owner, a factory-trained technician from the equipment supplier shall inspect, test and adjust the complete CCTV System.

B. The Owner’s acceptance test will only be made after the above inspection, testing and adjusting of the complete CCTV System is performed, and the test report results are turned over to the Owner for evaluation. The Owner's test will be the same as the above Contractor’s tests. The Contractor shall perform these tests in the presence of the Owner or the Owner's representative.

4.3 FIELD ADJUSTMENTS

A. Repair or replace, at contractor’s expense, any defective devices, equipment or wiring and again perform any and all testing required to demonstrate that the system is in full compliance with the drawings and specifications.

B. The cost of any re-testing as a result of the failure of the system to operate in accordance with these specifications and/or non-compliance with the drawings or applicable codes shall be paid by the Contractor to the Owner. A purchase order shall be delivered to the Owner before the re-testing is scheduled or started.

4.4 POST-ACCEPTANCE ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of Substantial Completion, provide on- site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to the Project during normal hours for this purpose. Tasks shall include:

1. Check cable connections

2. Check proper operations of cameras and lenses.

3. Provide a written report of adjustments and recommendations.

4.5 TRAINING

A. Upon the completion of all work and of all tests, furnish the necessary skilled labor for providing operating instructions of all systems and equipment for a minimum period of four (4) hours of documented formalized instruction for the Owner, detailing the proper operation and maintenance of the installed system.

B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

END OF SECTION

SECTION 283111 – DIGITAL ADDRESSABLE FIRE ALARM SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire alarm system; complete, including all wiring, raceways, terminal cabinets, pull boxes, outlet and mounting boxes, initiating devices, alarm indicating devices, annunciator(s), control equipment, tests, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.

B. Verify requirements with Jurisdictional authorities, i.e.: Insurance authority or Underwriter, Fire Department or Marshal, or Building Department. Provide system complete, functional and acceptable to Jurisdictions without penalty of any type to the insurance premium rate.

C. This Contractor shall be completely responsible for all aspects of coordination with other sections of these specifications and drawings. No change will be issued for lack of coordination or lack of verification of requirements of Jurisdictional Authorities.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project. Installer shall be able to produce, upon request, references and proof of five (5) years minimum experience in the installation of systems of comparable size and performance to that specified.

B. Manufacturer’s Representative: The system shall be provided and commissioned by the authorized Manufacturer’s Local Representative. This representative shall provide documentation that the organization is factory certified on the system. This organization must maintain a qualified technical and engineering staff to program and service the system. This distributor shall fully stock and show evidence that they maintain a complete inventory of spare parts to properly and promptly service the system. Before commencing work, submit data showing the commissioned fire alarm systems of the same type and design as specified. He shall include the names and locations of at least five such installations within one hundred miles of the project. Specify type and design for each system and furnish documentation that the system has performed satisfactorily for the proceeding 48 months.

C. The system control panel, annunciators, devices specified, and their installation and operation shall conform to the most stringent applicable requirements of the following codes and standards, and this specification unless otherwise noted:

1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
2. National Fire Protection Association (NFPA) 72, National Fire Alarm Code
3. National Fire Protection Association (NFPA) 101, Life Safety Code
4. The Americans with Disabilities Act (ADA)
5. National Electrical Manufacturers Association (NEMA)
6. Underwriters Laboratory (UL) listed and labeled.
7. Factory Mutual (FM) Approval.
8. American National Standards Institute (ANSI) C57
9. Federal Communications Commission (FCC)
10. International Fire Code (IFC)
11. The current governing building codes, as adopted.
12. All other applicable local, state, and national codes, as adopted

D. The control panel, annunciators, all initiating and indicating devices and all other devices connected to the system shall be UL Listed as provided and shall bear UL labels for the applicable NFPA fire alarm standards for which the equipment is to be used.

1. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems, except as modified and/or supplemented hereinafter.
2. The fire alarm control panel shall comply with the requirements of UL-864 Control Units for Fire Protective Signaling Systems, 9th Edition and UL-1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems.

E. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building. Building owner shall be notified 48 hours in advance if normal building operations are to be interrupted - building interruptions shall occur only at the convenience of the owner.

1.3 SYSTEM DESIGN REQUIREMENTS

A. System design shall be the sole responsibility of the Installer/Manufacturer’s Representative. These specifications and associated drawings are provided for purposes of conveying the design intent of the project and shall not be considered as all-inclusive or limiting the possible system configurations.

B. Verify requirements with jurisdictional authorities (i.e. Insurance Carrier or Underwriter, Fire Department or Marshall, or local Building Code Department). This contractor shall

be responsible for providing a complete and functional system, acceptable to the jurisdictions involved.

C. Contractor shall be responsible for all aspects of coordination with other Sections or Divisions of these specifications and/or drawings. No change will be issued due to lack of coordination or failure to verify jurisdictional requirements.

D. Designer shall be NICET certified in the design of fire alarm and signaling systems, as required by applicable Authority Having Jurisdiction.

1.4 SUBMITTALS

A. Submit the following information in accordance with the requirements of section 280500 and General Conditions of Contract.

B. Contractor shall submit shop drawings, product data and calculations to the Authority Having Jurisdiction, Fire Department/Marshall, Owner's Insurance Underwriter and/or other regulatory agency, and obtain approvals prior to submission to Engineer for review. Include approval documentation with submission to Engineer. Engineer will not review submittals without written documentation of approval by Authorities Having Jurisdiction.

C. Provide complete submittals, which shall include schematic wiring drawings of the control panel showing internal and external control panel wiring and all devices. Floor plans/device layout drawings, sequence of operation, annunciator wiring schematics, battery calculations, and specification sheets for all equipment, all devices shall be provided. Drawings shall be done on full size sheets and to scale (1/8"=1'-0" minimum). Partial submittals will not be accepted.

D. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

E. If re-submittals are required, they shall be provided within two (2) weeks after the date of notification. If re-submittals are not received by the Engineer in two (2) weeks, the supplier will be considered nonresponsive and subsequent submittals from the supplier will not be reviewed. The Contractor shall then provide submittals from another equipment supplier within two (2) weeks as directed by the owner at no change in contract price.

F. The cost of review of any submittals after two (2) submittals have been rejected shall be paid by the Contractor to the Engineer. Prior to re-submittal, purchase order shall be delivered to the Engineer before additional reviews of submittal start.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 280500 and General Conditions of Contract:

1. Instruction books and/or leaflets
2. Recommended renewal parts list
3. Final as-built drawings
4. Complete Wiring diagrams
5. NFPA 72 Test Report/Certificate

1.6 DEFINITIONS

A. Alarm-Initiating Device: A system component that originates transmission of a change-of-state condition, such as a manual pull station, smoke detector, heat detector, supervisory switch, etc.

B. Alarm Signal: Signifies a state of emergency requiring immediate action. Pertains to signals such as the operation of a manual station, the operation of a sprinkler system flow switch, etc.

C. Class A Wiring: Circuits arranged and electrically supervised so a single break or single ground fault condition will be indicated by a trouble signal at the fire alarm control panel (FACP) and the circuit will continue to be capable of operation for its intended service in the faulted condition no matter where the break or ground fault condition occurs.

D. Class B Wiring: Circuits electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FACP no matter where the break or ground fault condition occurs.

E. Hard-Wired System: Alarm, supervisory, and initiating devices directly connected, through individual dedicated conductors, to a central control panel without the use of multiplexing circuits or devices.

F. Multiplex System: One using a signaling method characterized by the simultaneous or sequential transmission, or both, and the reception of multiple signals in a communication channel, including means for positively identifying each signal (also referred to as an Addressable System).

G. Supervisory Signal: Indicates abnormal status or need for action regarding fire suppression or other protective system.

H. Trouble Signal: Indicates that a fault, such as an open circuit, ground, etc. has occurred in the system.

I. Zone: A building area that has all initiating devices located within it programmed to initiate an alarm and to give a common location indication on the system FACP and annunciator.

1.7 SYSTEM DESCRIPTION

A. General: UL and FM listed. Complete, zoned, non-coded, addressable, microprocessor-based fire detection and alarm system with manual and automatic alarm initiation, intelligent analog addressable smoke detectors, and automatic alarm verification for alarms initiated by certain smoke detectors as indicated.

B. Signal Transmission: Multiplex signal transmission dedicated to fire alarm service only.

C. Audible and Visual Alarm Indication: By sounding of audible notification devices and visual alarms.

D. System connections for alarm-initiation and alarm-indicating circuits: Class B (Style 4) wiring.

1.8 RECORD DOCUMENTS

A. The As-Built drawings shall include three (3) complete sets of 30" x 42" contract base sheet drawings with any and all changes included and noted. The approved contract panel drawings and annunciator panel drawings shall also be provided on 30" x 42" reproducible. The Conduit Plan shall show the device address for all intelligent/analog-initiating devices. The As-Built drawings shall be kept up to date continuously by the electrician in charge of the system installation. These drawings shall be reviewed on a weekly basis for accuracy and completeness.

B. The Operation and Maintenance Manual shall include a complete set of equipment, component and device specification and data sheets as well as a reduced size paper copy (half-size or 11” x 17”) of the complete set of system drawings described in paragraph 1.4. A copy of the NFPA 72 Test Report/Certificate, a printed record of all test activity including the sensitivity readings for all intelligent/analog smoke detectors, the required system and component warrantee papers, and the name and address of the installer shall be included. The manual shall be bound in a black three ring loose leaf binder with dividers and a table of contents. Three (3) duplicate sets are required.

C. Five (5) sets of keys to all locks shall be provided in a proper key box or binder with each set of keys properly and legibly marked and tagged. Loose keys will not be accepted.

D. All documents and items described above shall be submitted for approval and turnover prior to the final testing and system certification with the exception of the NFPA 72 Test Report/Certificate which shall be delivered by hand to the owner within two (2) days of the actual test and acceptance. One copy of the Test Report/Certificate shall be submitted to the Engineer.

1.9 ACCEPTANCE OF SYSTEM

A. Total acceptance of the system will only be made after the required tests, complete record document package and the instruction period have been provided.

1.10 GUARANTEE

A. Guarantee the labor, materials and equipment provided under this contract against system defects for a period of one (1) year after the date of final acceptance of this work by the Owner.

B. Provide service by the equipment supplier during the guarantee period, seven (7) days a week, including holidays, within four (4) hours after notification. Repairs shall be affected within twenty-four (24) hours of notification.

C. Should the Contractor fail to comply with the above requirements, the Owner will then have the option to make the necessary repairs and back charge the Contractor without any loss of warranty or guarantee as provided by the contract.

D. Any guarantee which is in conflict with the above will not be acceptable.

1.11 EXTRA MATERIALS

A. Spare Parts: At the completion of the project, the electrical contractor shall turn over to the Owner, with transmittal documentation, the following extra materials described below (match products installed, package with protective covering for storage, and identify with labels describing contents):

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
3. Smoke Detectors, Heat Detectors, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than one unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than one unit of each type.
5. Keys and Tools: One extra set for access to locked and tamperproof components.

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers (No exceptions: For campus standardization):

1. Simplex-Grinnell

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Control of System: By the FACP. Provide all programming required for a complete and operating fire alarm and detection system, to the complete satisfaction of the Owner and the Architect. Backup of program shall be provided

B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.

C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.

D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.

E. Transient voltage Protection: Provide protection on all circuits in accordance with manufacturer's recommendation.

F. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.

G. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and two (2) telephone lines.

H. Loss of primary power at the FACP initiates a trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.

I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a flame or heat detector, operation of a sprinkler flow device, or verified automatic alarm operation of a smoke detector initiates the following:

1. Notification-appliance operation.
2. Audible and visual annunciation of ‘alarm’ condition at the FACP and the remote annunciator(s).
3. Identification, in plain-text English via alpha-numeric display, at the FACP and the remote annunciator(s) of the device originating the alarm.
4. Transmission of an alarm signal to the remote alarm receiving station.
5. Unlocking of electric door locks in designated egress paths.

6. Release of fire and smoke doors held open by magnetic door holders.
7. Shutdown of fans and other air-handling equipment serving zone where alarm was initiated.
8. Closing of smoke dampers in air ducts of system serving zone where alarm was initiated.
9. Recording of the event in the system memory.
10. Alarm Silencing, System Reset and Indication: Controlled by switches on the FACP and the remote annunciator.
11. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
12. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
13. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

J. Smoke detection for zones or detectors with alarm verification initiates the following:

1. Audible and visible indication of an "alarm verification" signal at the FACP.
2. Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
3. General alarm, once the alarm condition is verified. Activation of a second smoke detection device during the verification period shall automatically activate general alarm.
4. Cancellation of the FACP indication and system reset if the alarm is not verified.

K. Sprinkler valve-tamper switch operation initiates the following:

1. A supervisory, audible and visible "valve-tamper" signal indication at the FACP and the annunciator.
2. Identification, in plain-text English via alpha-numeric display, at the FACP and the remote annunciator(s) of the device that has operated.
3. Transmission of supervisory signal to remote alarm receiving station.

L. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system initiates the following:

1. A supervisory, audible and visible "sprinkler trouble" signal indication at the FACP and the annunciator(s).
2. Identification, in plain-text English via alpha-numeric display, at the FACP and the remote annunciator(s) of the device that has operated.
3. Recording of the event by the system printer.

4. Transmission of trouble signal to remote central station.

M. Removal of an alarm-initiating device or a notification appliance initiates the following:

1. A "trouble" signal indication at the FACP and the annunciator(s).
2. Identification, in plain-text English via alpha-numeric display, at the FACP and the remote annunciator(s) of the device or zone involved.
3. Transmission of trouble signal to remote alarm receiving station.

N. Permissible Signal Time Elapse: The maximum permissible elapsed time between the actuation of any fire alarm or fire-detection system alarm-initiating device and its indication at the FACP is ten seconds.

O. Circuit Supervision: Indicate circuit faults by means of both a zone and a trouble signal at the FACP. Provide a distinctive indicating audible tone and (LED) indicating light. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.

P. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

Q. Connect new fire alarm control panels to existing fire alarm control panel in Bowman Center. Provide all required expansion cards/equipment to make this integration.

2.3 MANUAL PULL STATIONS

A. Description: Fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.

1. Single-action mechanism, with positive visual indication of activation, initiates an alarm. Pull stations shall incorporate a key reset device. In existing buildings, match reset device type of new devices with existing (key or allen wrench).
2. For manual pull stations exposed to weather, provide weatherproof protective shield factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.
3. For manual pull stations in locations exposed to residents/patients, provide protective shield factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.
4. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

5. Pull station body shall be red, with clearly visible operating instructions provided on the cover. The word “fire” shall appear on the front of the station in raised letters of contrasting color.

2.4 SMOKE DETECTORS

A. General requirements:

1. Operating Voltage: 24-V dc, nominal.
2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
5. Sensitivity: Can be tested and adjusted in-place after installation.
6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
7. Photoelectric Smoke Detectors include the following features:
   a) Sensor: LED or infrared light source with matching silicon-cell receiver.
   b) Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
   c) Where combination smoke/thermal detectors are noted to be utilized on the drawings, provide integral Thermal Detector: Fixed-temperature type with 135 degrees F setting.
   d) Audible Detector base – Addressable (in sleeping areas):
      1) Detector bases shall be low profile twist lock type with screw clamp terminals and self-wiping contacts. Bases shall be installed on an industry standard, 4" square or octagonal electrical outlet box.
      2) Where indicated on the drawings, furnish detector base with integral approved 520 Hz audible evacuation alarm signal having an output of 85db @ 10’. The audible signal shall be individually addressable and software programmed for operation.
8. Carbon Monoxide Detector (to be utilized only where specifically noted on plans) shall include the following features:
   a) Same general requirements for smoke detectors listed above.

b) Detector shall incorporate an addressable Carbon Monoxide (CO) detector. The CO detector shall be selectable as a multi-criteria fire detector or as a smoke detector and independent CO detector (in compliance with NFPA 720).

c) Detector shall be UL 2075 compliant as a gas and vapor detector.

9. Duct Smoke Detectors: Photoelectric type with duct-mounted housing.

a) Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied. Sampling tube shall be sloped downward from the detector housing. Sampling tube holes shall be oriented toward the air stream in the duct.

b) Smoke Detector: Shall be photoelectric type with UL listed air velocity range of 300-4,000 feet per minute.

c) Relay Fan Shutdown: Isolated auxiliary contact, rated to interrupt fan motor-control circuit.

i. Wiring between aux. contact and ATC system provided by Mechanical Contractor.

10. “In Duct” Smoke Detectors: Photoelectric type with “in duct” housing.

a) Mounting box: Mounted on outside of duct with transparent housing cover to allow viewing of status LED’s. Mounting box shall include gasket on mounting box side shared with duct. Mount smoke detector on extension conduit (located between mounting box and smoke detector base). Smoke detector base shall include gasket where mounted to extension conduit. Coordinate mounting with duct shape.

b) Smoke Detector: Shall be photoelectric type with UL listed air velocity range of 0-2,000 feet per minute.

c) Relay Fan Shutdown: Isolated auxiliary contact, rated to interrupt fan motor-control circuit.

i. Wiring between aux. contact and ATC system provided by Mechanical Contractor.

2.5 HEAT DETECTORS

A. Heat Detector, Fixed-Temperature/Rate-of-Rise Type: Actuated by temperature that exceeds a fixed temperature of 135 degrees F. Rate-of-rise element shall be rated at 15 degrees F per minute.

1. Mounting: Plug-in base, interchangeable with smoke detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 NOTIFICATION DEVICES

A. Description: Equip for mounting as indicated and have screw terminals for system connections.

B. Existing facilities: New notification devices in existing facilities shall match existing installed devices relative to sound and tone.

C. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly. Device shall have field selectable output for audible and visual settings.

D. Electronic Horns: Electronic sounder, rated for 24-V dc operation; with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet from the horn. Housing shall be red in color, with the word “FIRE” clearly printed in white. Device shall have field selectable output for audible setting.

E. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. Housing shall be red in color, with the word "FIRE" clearly printed in white.

1. Strobe Leads: Factory connected to screw terminals.
2. Minimum strobe intensity for devices is noted on drawings.
3. All strobe lights visible within the same area shall be fully synchronized.
4. Device shall have field selectable output for visual settings.

2.7 REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES

A. Description: LED indicating light near each smoke detector that may not be readily visible, and each sprinkler water-flow switch and valve-tamper switch. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single gang plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

B. Mounting: Typically mounted in ceiling in close proximity to smoke detector.

2.8 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.

2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.

3. Rating: 24 VAC or DC.

4. Material and Finish: Match door hardware - attachment to door shall be approved by architect.

2.9 FIRE ALARM CONTROL PANEL (FACP)

A. Cabinet: Lockable steel enclosure. Arrange interior components so operations required for testing or for normal maintenance of the system are performed from the front of the enclosure. If more than one unit is required to form a complete control panel, fabricate with matching modular unit enclosure to accommodate components and to allow ample gutter space for field wiring and interconnecting panels.

1. Identify each enclosure with an engraved, red, laminated, phenolic-resin nameplate with lettering not less than 1 inch high. Identify individual components and modules within cabinets with permanent labels.

2. Mounting: As noted/shown on drawings.

B. Alarm and Supervisory Systems: Separate and independent in the FACP. Alarm-initiating zone boards consist of plug-in cards. Construction requiring removal of field wiring for module replacement is unacceptable.

C. Control Modules: Include types and capacities required to perform all functions of fire alarm systems.

D. Indications: Local, visible, and audible signals announce alarm, supervisory, and trouble conditions. Each type of audible alarm has a different sound.

E. Resetting Controls: Prevent the resetting of alarm, supervisory, or trouble signals while the alarm or trouble condition still exists.

F. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components, including annunciation, supervision, and control.

1. Display: Back-lit, 80-character minimum LCD display, utilizing plain-text English, for alarm, supervisory, and component status messages; and indication of control commands to be entered into the system for control of smoke detector sensitivity and other parameters.

2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

G. Instructions: Printed or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

H. All interfaces and associated equipment, including main and auxiliary power supplies, shall be protected so that they will not be damaged or affected by voltage surges or line transients.

2.10 REMOTE ANNUNCIATOR

A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, reset, and test.

B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

2.11 EMERGENCY POWER SUPPLY

A. General: Components include valve-regulated, recombinant lead acid battery; charger; and an automatic transfer switch.

1. Battery Nominal Life Expectancy: 20 years, minimum.

2. Battery Capacity: Comply with NFPA 72. Batteries shall be sufficient to operate the system for a minimum of 24 hours in ‘Standby’, followed by 5 minutes in ‘Alarm.’ If required, provide remote power panels with battery backup same as the main control panel. Extend 120 VAC source from the main control panel. Coordinate location of remote power supply panel(s) in the field with the Owner/Architect.

3. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.

B. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger recharges them completely within four hours. Charger output is supervised as part of system power supply supervision.

C. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

D. The FACP shall be served by the emergency generator. It is the responsibility of the Electrical contractor to insure the required functioning of the FACP during the time generator is running.

2.12 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for alarm-initiating devices (with normally open contacts).

B. Provide an Integral Addressable Interface (IAI) device or relay and associated circuitry, etc., for each fire protection alarm initiating device as required.

1. Provide additional addressable relays/addressable monitors, and associated circuitry, to perform auxiliary functions indicated on the drawing or required by applicable codes.

2. Coordinate exact quantities with Fire Protection Contractor.

2.13 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled under UL 864 and NFPA 72.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP panel, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising two lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

D. Self Test: Conducted automatically every 24 hours with report transmitted to central station.

E. The digital alarm communicator transmitter (DACT) and the fire alarm control panel shall be arranged to transmit zones as defined by the Owner. The system shall be capable of transmitting a distinct signal for each zone to the monitoring station's facilities, including spare zones. A trouble or low battery condition associated with the DACT shall be transmitted to the monitoring station.

F. The supplier of the DACT shall coordinate compatibility with the central monitoring station. All labor and hardware required to obtain compatibility with the monitoring station shall be the included. Forward a letter to the Architect/Engineer stating that this coordination has been done and that the proposed communicator system is completely compatible with the central monitoring station's equipment.

2.14 FACP CONNECTION TO AUTOMATIC TEMPERATURE CONTROL PANEL

A. Provide complete functioning interconnection to building automatic temperature control panel as shown on drawings.

B. It is the electrical contractor's responsibility to provide required hardware and software in Fire Alarm System to allow for full integration with the A.T.C. system by means of a

data connection acceptable to both systems. Full integration shall provide point-specific information about the status of fan and smoke damper shutdown operation to the A.T.C. panel.

2.15 GUARDS FOR PHYSICAL PROTECTION

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Utilized on all devices in gymnasium and on other devices as noted on drawings.
2. Factory fabricated and furnished by the manufacturer of the device.
3. Finish: Paint of color to match the protected device.

2.16 EXTERIOR EQUIPMENT

A. Any devices, junction boxes, or equipment associated to the fire alarm system located exterior to building shall be gasketed and approved for use in wet environments. Conduit to exterior devices shall be sealed in order that water cannot gain access to interiors of devices via conduit system.

2.17 WIRE

A. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 degrees C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer. MANUAL PULL STATIONS

2.18 PULL BOXES AND TERMINAL CABINETS

A. Pull boxes shall be Hoffman NEMA type 1 hinged cover cabinets only. Sizes as shown on the fire alarm system drawings or as required by code. Paint all pull box doors red and label F/A PULL BOX.

B. Terminal cabinets shall be Hoffman NEMA type 1 hinged cabinets with a painted steel removable subplate and ‘T’ handle latch. No locks are required. Each terminal cabinet shall have a factory painted red finish. Provide on the door of each terminal cabinet a red lamacoid nameplate with ¾ inch white letters to read Fire Alarm Terminal Cabinet #__. Flush cabinets shall be the same type except for factory supplied flush mounting trim. Provide one (1) IDEAL (389-061) terminal block per wire entering and leaving the terminal cabinet, plus 10% spare terminal blocks. Mount terminal blocks vertically and use the appropriate terminal block mounting channel and terminal block end plates (89-062) as recommended by the manufacturer. Each terminal shall be properly identified

and the respective Terminal Cabinet Directory as shown in the drawings shall be attached to the inside cover with an adhesive backed vinyl envelope.

3 EXECUTION

3.1 INSTALLATION

A. SCOPE

1. The system shall electrically supervise all wiring between the control panel and all initiating and indicating devices.
2. The system shall be capable of differentiating between a system trouble condition and the activation of a supervisory device.
3. A complete NFPA 72 test shall be done and a system status report issued prior to the start of any modification to existing functioning fire alarm systems.

B. EQUIPMENT INSTALLATION

1. All wiring shall be installed in conduit except as otherwise shown. Entire conduit system housing fire alarm cabling shall be red in color. Prepainted EMT conduit shall be as manufactured by Allied Tube and Conduit or approved equal.
2. All conduits, cabinets and device back boxes shall be recessed unless shown otherwise on the drawings and as directed by the Architect or Engineer.
3. Provide smoke detector above fire alarm control panel and each auxiliary power supply (not shown on floor plans).
4. All spot type detectors shall be located on the suspended ceilings, except as noted. If suspended ceilings do not exist, the detectors shall be mounted on the slab.
5. All detectors shall be centered in the ceiling tiles and back boxes and conduits shall be recessed in areas with suspended ceilings. The back boxes and conduits for detectors on the slab shall be surface mounted with conduits run perpendicular/parallel to the walls.
6. All detectors shall be located at the highest point on the ceiling or slab except as specifically noted.
7. Exact location of all automatic detectors shall be as directed by the manufacturer's representative.
8. Smoke detectors shall not be located within three (3) feet of or in the direct air stream from supply air diffusers. Additionally, smoke detectors shall not be located within three (3) feet of return air grilles.
9. Automatic detectors shall not be mounted on or within three (3) feet of doorways, beams, columns or walls, except smoke detectors at doors with door holders shall be mounted between two (2) and four (4) feet from the doors.

10. Duct detectors shall be required in the supply-side and return-side ductwork of all air handling units with airflow greater than 2,000 CFM.

11. Furnish duct smoke detectors or “in duct” type smoke detectors for the control of all smoke (or combination fire/smoke) dampers.

12. The Electrical Contractor shall furnish duct smoke detectors, and the Mechanical Contractor shall install them. The Electrical Contractor shall provide all fire alarm wiring and interconnections. All power and/or control wiring required for the operation of smoke dampers or for the shutdown of air handling units shall be provided by the Mechanical Contractor.

13. All manual stations located at egress doors shall be located adjacent to and within five (5) feet of the respective egress doors.

14. All detectors mounted on suspended ceilings shall be connected to pull boxes mounted on the slab with flexible conduit that shall be long enough to move the detector five (5) feet in any direction.

15. Detector bases shall be mounted on ceiling outlets so that indicator lamps are visible from the floor below, or from the nearest equipment aisle, or from the doorway entering the room, as applicable.

16. The conduit, device back boxes, pull boxes, terminal cabinets, panels and wiring as shown on the Fire Alarm System drawings shall be installed as shown. The device back boxes and conduit wire fill shall be in compliance with the National Electrical Code.

17. Provide white lamacoid nameplates on the ceiling grid with ¼ inch red letters to identify all above ceiling devices.

18. The fire detection and alarm system shall be operational at all times, except that when work is being performed on the system during normal working hours only those portions actually undergoing modification shall be out of service. All detectors in the construction area shall be bagged with plastic bags during the working hours and de-bagged after working hours.

19. At the end of each workday, and before workmen leave the site, proper operation of the system shall be demonstrated to the designated Owner’s representative.

C. WIRING INSTALLATION

1. All alarm initiating devices and supervisory initiating devices shall be connected on Class B (Style 4) two (2) wire Signaling Line Circuits (SLC). Unsupervised wiring (point wires) shall not be permitted. T-tapping and parallel branch circuit wiring shall be permitted on the addressable SLCs, in accordance with the manufacturer’s recommendations.

2. All alarm indicating devices shall be connected on Class B two (2) wire electrically supervised circuits and on a minimum of two active circuits.

3. Wiring to initiating and supervisory devices and to fire alarm annunciators shall be with two- (2) conductor, twisted solid copper UL listed fire alarm system wire subject to manufacturer’s recommendations (#16 AWG minimum).

4. Wiring to alarm indicating devices shall be with two- (2) conductor twisted solid copper UL listed jacketed fire alarm system wire subject to manufacturer's recommendations (#14 AWG minimum).

5. All other wiring shall be as recommended by the system manufacturer.

6. No splicing of wires is permitted except on terminal blocks in annunciators, control panels or properly labeled terminal cabinets as shown on the drawings. The use of wire nuts or similar type devices is not permitted. All devices shall have terminals for each wiring connection. No splicing of any type shall be permitted in pull boxes, to include crimp terminals.

7. All wires shall be labeled at both ends with ¾” x 1-3/9” ScotchCode SWD Write-On Tape and SMP Write-On Marking Pen only.

8. Use plastic wire ties and wire tie mounts to insure a neat quality appearance.

9. Provide for the control panel a power feed of 120 volts, single phase using 3#10 minimum solid copper conductors in conduit from the load side of the normal power/emergency power transfer switch to a two (2) circuit plug fuse type fuse panel painted red without disconnect switch and mounted adjacent to the control panel. Identify as Fire Alarm Fuses engraved on a red lamacoid name plate with ½ inch white letters. The fuses shall be rated for not more than 20 amperes.

3.2 TESTS

A. Prior to the acceptance test of the project by the Owner, a factory-trained technician from the equipment supplier shall inspect, test and adjust the complete Fire Alarm System according to NFPA-72, including, but not limited to, the following:

1. Existing system in facility where equipment is being interconnected/added.

2. Visual inspection of all equipment.

3. Verification of alarm, supervisory and trouble signals at all receiving locations and circuits, including audible and visual alarms, annunciators, control panels, and central monitoring control panel.

4. Test each alarm initiation device for alarm and correct annunciation.

5. Test each alarm bell and strobe light for proper operation.

6. Test the sensitivity of each smoke detector with a manufacturer's detector test set (the fire alarm control panel shall be UL listed for this purpose). Retain a printed recorded of all firing voltages. Correlate firing voltage records to the device addresses as shown on the as-built drawings.

7. Test the operation of each magnetic door holder, elevator recall and elevator shutdown operation, damper closure and smoke control

8. Check all end of line devices for proper installation and polarity.

B. All smoke detector sensitivity adjustments and tests shall be performed:

1. From the Fire Alarm Control Panel with each detector in its exact operating location and not at some convenient place.

2. Only under normal, balanced and completed maximum air flow conditions, with supply air systems constant and not undergoing balancing or other alterations, and air conditioning refrigeration systems operating properly.

3. A complete printout showing all sensitivity readings shall submitted.

C. After the system has been installed, the DACT shall be completely tested by the equipment manufacturer's representative for proper operation. A letter shall be provided to the Owner by the manufacturer's representative confirming the test, indicating their approval and that all zones are capable of being transmitted to and satisfactorily received by the central monitoring station.

D. The Owner’s acceptance test will only be made after the above tests are made and the copy of the NFPA 72 Test Report/Certificate results is turned over to the Owner for evaluation. The Owner's test will be the same as the above Contractor’s tests. Demonstrate to the Owner that no wire nuts or similar devices have been used in the system. Perform these tests in the presence of the Owner or the Owner's representative.

3.3 FIELD ADJUSTMENTS

A. Repair or replace at his expense any defective devices, equipment or wiring and perform additional testing required to demonstrate that the system is in full compliance with the drawings and specifications.

B. The cost of any re-testing as a result of the failure of the system to operate in accordance with these specifications and/or non-compliance with the drawings or applicable codes shall be paid by the Contractor to the Owner. A purchase order shall be delivered to the Owner before the re-testing is scheduled or started.

3.4 TRAINING

A. Upon the completion of all work and of all tests, furnish the necessary skilled labor for providing operating instructions of all systems and equipment for a period of one (1) day of eight (8) hours for each building or as otherwise directed. During this period, instruction will be given to the owner or his representative(s) in the full operation, adjustment and maintenance of all equipment furnished or provided.

END OF SECTION

SECTION 283165 – AREA OF RESCUE ASSISTANCE SYSTEMS

1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Performance of all labor and providing and installing all materials, components and accessories as required for the construction of the project as indicated by contract documents.

2. Equipment specified in this section includes but is not limited to the following:

a) Area of Rescue Assistance (ARA) System

1.2 OVERVIEW

A. Furnish, install, and wire all equipment associated with the installation of an Audio-Visual Rescue Assistance Signal System to comply with ADA requirements. This work shall include an IP Command Center, IP Call Boxes, distribution module, outlet boxes, cables, wiring, conduit, etc. as shown on the drawings and as specified herein. The system shall provide a means to indicate that a call has been acknowledged, have battery backup and have all wiring supervised.

B. Perform a complete functional test of the system upon completion of the installation and instruct the staff in the operation and maintenance of the system.

1.3 SUBMITTALS

A. Submit the following information in accordance with the requirements of section 280500 and General Conditions of Contract.

B. Contractor shall submit shop drawings, product data and calculations to the Authority Having Jurisdiction, Fire Department/Marshall, Owner’s Insurance Underwriter and/or other regulatory agency, and obtain approvals prior to submission to Engineer for review. Include approval documentation with submission to Engineer. Engineer will not review submittals without written documentation of approval by Authorities Having Jurisdiction.

C. Provide complete submittals, which shall include schematic wiring drawings of the control panel showing internal and external control panel wiring and all devices. Floor plans/device layout drawings, sequence of operation, annunciator wiring schematics, and specification sheets for all equipment, all devices shall be provided. Drawings shall be done on full size sheets and to scale (1/8”=1’-0” minimum). Partial submittals will not be accepted.

D. System Operation Description: Detailed description for this Project, including method of operation and sequence of operations. Manufacturer's standard descriptions for generic systems are not acceptable.

1.4 QUALIFICATIONS

A. Manufacturer: Equipment manufactured by Rath Area of Refuge, or equal, and others as listed shall be considered as meeting these specifications. The naming of the manufacturer or item of material is not intended to be restrictive, but rather to establish criteria for design and quality. Catalog and model numbers are intended to indicate type, quality of design, material, as well as exact operating features required.

B. Supplier: The supplier must have a minimum of five years experience in the design and installation of systems equal in size and type required by this project. The supplier must maintain a local service organization within a fifty (50) mile radius of the installation with spare service replacement components and accessories.

C. The supplier must be the authorized representative of the equipment manufacturer supplied and have full-time technicians trained and certified in the installation and service of the equipment supplied.

1.5 REGULATORY REQUIREMENTS

A. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction, and that portion of the NEC which pertains to installation and construction of specified products.

B. Americans with Disabilities Act (ADA): Comply with ADA requirements for area of rescue assistance systems.

1.6 MAINTENANCE SERVICE WARRANTY

A. Special Project Warranty: Submit a written warranty, executed by the contractor, installer, and the manufacturer, agreeing to repair or replace equipment which fails in material or workmanship within the specified warranty period. This warranty shall be in addition to and not a limitation of other rights the owner may have against the contractor under the contract documents.

B. Warranty of Conformance with Specifications: The contractor shall warrant that all specified functions shall be provided even if functional omission is not discovered until the end of the warranty period. This shall warranty full function of the system even if the owner does not fully utilize the capabilities of the system initially.

C. Warranty period is one (1) year after the Date of substantial Completion.

1.7 OPERATION

A. Under normal conditions, the ARA system is disabled by the Fire Alarm Control Panel. In the event of an alarm, the ARA system becomes enabled.

2 PRODUCTS

2.1 EQUIPMENT

A. This system shall consist of multiple remote call boxes, which will share a common command center.

B. The Emergency communication hardware shall comply with the Americans with Disabilities Act (ADA).

C. The 120vac Power Supply model RP7700104 must be capable of supplying power to a minimum of one Base Station and one Distribution Module.

2.2 IP COMMAND CENTER & DISTRIBUTION MODULE

A. The IP Command Center (2500 series) shall include both the Base Station and Distribution Module. The Base Station must have a powder coated steel housing (surface or flush mount), include a black handset with coil cord.

B. The IP Command Center is to be powered by the Distribution Module.

C. Distribution Module must be a surface mount enclosure and include connections for the IP Call Boxes.

D. The Distribution Module shall be powered from 120vac power with a battery backup that provides power for a minimum of 4 hours (RP7700104).

E. The IP Command Center is to be located at a central control point on the first floor or as determined by local Authority having jurisdiction.

F. The IP Command Center must be capable of connecting to an existing Network and providing inputs for the IP Call Boxes.

G. Visual indicators on the IP Command Center allow Rescue personnel to know which IP Call Box needs assistance.

H. The IP Command Center must allow Rescue personnel to speak to each IP Call Box individual.

I. The IP Command Center must include both a handset and speakerphone to communicate back to the IP Call Boxes.

J. The IP Command Center must provide an audible and visual indicator that an IP Call Box has been activated.

K. The IP Command Center is to be mounted on a flat wall surface.

2.3 REMOTE CALL BOXES

A. The IP Call Box shall have the ability to be programmed with up to 2 emergency phone numbers (either both Off-Site or Base Station and Off-Site). Upon activation of the

emergency push button, a call will be automatically placed to the IP Command Center. If no one answers at the IP Command Center, the IP Call Box must dial a secondary location outside the building to activate two way off-site person to person voice communications.

B. IP Call Boxes are to be located on all floors above and below the first floor, ideally next to a stairwell emergency exit or elevator landing on each floor.

C. IP Call Boxes require a hands-free speakerphone with an LED to indicate status of call.

D. The IP Call Boxes must allow the programming in of a specific location message of the unit. This allows Rescue personnel to know the location of the activated IP Call Box.

E. The IP Call Boxes are to be located no higher than 48” front reach or 54” side reach, to the center of the push button, above ground level to ensure conformance with the ADA requirements.

F. The IP Call Boxes must have a Braille faceplate to ensure conformance with the ADA requirements.

G. The IP Call Boxes are to be wall surface or flush mounted.

H. The IP Call Boxes are to be powered by PoE at 802.3af or a separate battery backed up 12v source.

I. The IP Call Boxes shall be an ADA compliant and vandal resistant speakerphone.

J. The IP Call Box shall have Location Message capability. IP Call Box must have a minimum 18 second recordable message capability, programmable to play 1 or 2 times. IP Call Box shall notify called party of the location of the call upon being received at the emergency dispatch center.

K. The IP Call Box shall be capable of allowing the called party to replay the Location Message if necessary to ensure an understanding of the caller location.

L. If system is not attended to 24 hours a day, the IP Call Box must dial a secondary location outside the building to activate two way off-site person to person voice communications.

M. Once call has been made (button pushed), the call can only be terminated by the called party.

N. The IP Call Box must have a red LED that will light up upon push of the button. The light shall be a solid color when the IP Call Box is activated, and will flash when call has been answered.

O. The IP Call Box must be capable of being programmed and reprogrammed On-site.

P. EEPROM memory to protect programming.

Q. Operating Temperature of between -40˚F to +150˚F (-40˚ to + 65˚ C)

2.3 Signage

A. A tactile sign (Part #7043/7044 or 7087) with raised letter and Braille shall be located at entrance to area.

B. Coordinate with architect.

2.4 Graphics

A. IP Command Center must include wording identifying the location of each IP Call Box and light an LED when a particular IP Call Box has been activated.

B. The IP Call Box wording must include “Help Phone”, “International Phone Symbol”, and raised Braille lettering.

3 EXECUTION

3.1 CABLING REQUIREMENTS

A. The Base Station shall connect to the Distribution Module with a single wire pair (10 zone).

B. Each IP Call Box shall connect to the Distribution Module through an Ethernet connection. Maximum run is 300’ between Network Switches.

C. System shall be in compliance with all state and local Electrical Codes.

3.2 INSTALLATION

A. Complete system shall be installed in strict accordance with manufacturer's recommendations.

B. Wiring shall be installed in raceways throughout the building. Conduit shall be 3/4" minimum.

3.3 INSPECTION AND TEST

A. A factory technician authorized by the manufacturer of the products installed shall make checkout and final connections to the system. In addition, factory authorized technicians shall demonstrate operation of the complete system and each major component to the staff.

B. All materials and installation shall be guaranteed to be free of defects in material and workmanship for one year after final acceptance of installation and tests.

C. All wiring shall test free from grounds and shorts.

3.4 TRAINING

A. Provide a minimum of two (2) hours of in service training with the system. These sessions shall be broken into segments that will facilitate the training of the system users in operating station equipment, user programming functions and program distribution equipment.

B. Provide three (3) sets of operating manuals and users' guides to the Owner at the time of the training.

END OF SECTION