

PART 1: GENERAL

1.1 RELATED DOCUMENTS

- A. Work under this section is subject to requirements of the Contract Documents, including General and Supplementary Conditions and applicable portions of Division 1 - General Requirements.

1.2 WORK INCLUDED

- A. Work of the Contract shall consist of furnishing all labor, tools, equipment, and materials to complete the Electrical Work as indicated on the Contract Drawings, described in these Specifications, and as listed below:

- 1. Systems that this Contractor shall furnish and install:
 - a. Complete power wiring to panels, motorized equipment, motors, miscellaneous outlets, and Owner's furnished equipment.
 - b. General wiring for power, lighting, and miscellaneous systems.
 - c. Materials and equipment for electrical work.
 - d. Electric distribution
 - e. Motor and equipment wiring, including units and fans, HVAC, plumbing, fire protection, medical gas, and medical equipment.
 - f. Fire alarm system.
 - g. Emergency lighting and power systems.
 - h. Television system including all wiring, jacks, terminations, etc.
 - i. Wiring of equipment furnished by others.
 - j. Empty conduit and backboxes for telephone and data.
 - k. Motor starters.
 - l. All other equipment, material, devices, accessories required and/or shown on the Drawings.
 - m. Provide light fixtures, exit signs, and other fixtures.
 - n. Motion sensors
 - o. Nurse Call
 - p. Supervised paging systems

- B. The Drawings and Specifications shall be understood to cover according to their intent and meaning, complete operating systems as shown on the Drawings and specified under appropriate Sections of the Specifications.

- C. Items and accessories or devices necessary to the complete a proper operation of any system shall be provided by the Contractor and Subcontractor for such system whether or not they are specifically called for by the Specifications and Drawings.

- D. Additional work includes, but is not limited to the following:

- 1. Site visit to examine the existing conditions that may affect the performance of the work specified.

2. It shall be the responsibility of each the electrical contractors to field inspect this project, prior to submitting their bid.
3. It shall be understood by submitting a base bid that any item required, even if not indicated in construction documents, to complete the intent of drawings and specification is included in base bid.
4. No additional compensation shall be rendered to the contractor for any item if visual confirmation of discrepancy(s) can be made by field verification.
5. Obtain and pay for all permits, licenses, approvals, reviews, utility shut-downs, tests and inspections.
6. Pipe sleeves through floors, walls, and structural elements of the building, set in coordinated locations.
7. All cutting, coring and patching of general construction as necessary for installation of the work specified. Smoke/fire stopping of all penetrations created by Electrical contracts. Provide a 2-part minimum fire stopping system complying with fire department approved, UL listed details, which establish a smoke or fire resistance rating equal to or greater than the wall or floor penetrated.
8. Provide demolition work as noted on the contract drawings.
9. Coordinated shop drawings and calculations; submit and obtain approval by the Architect and Engineer.
10. Clean-up, on a daily basis, of all debris associated with the installation of this work, as necessary to maintain the premises in a broom swept condition.
11. Testing, adjusting, retesting re-adjusting as may be required to obtain system acceptance by the Chicago Bureau of Inspectional Services, Owner's Insurance Underwriter, and Owner's Representative. Contractors shall remain responsible for their respective systems until all approvals are obtained.
12. Provide equipment manuals, record drawings, valve tag schedules, testing certificates and personnel instruction, prior to system turn-over to the Owner.

- E. The work in this Division includes providing all labor, materials, specialty products, and services for, and reasonably incidental to, the satisfactory completion of the Electrical systems, as indicated on the Contract Drawings, in the Specification Sections, and/or required by codes and referenced standards.

1.3 CODES AND REGULATIONS

- A. Work under the Electrical Sections shall comply with the latest edition of the following standards and codes.

National Electrical Code
International Building Code (IBC)
Design Guides, Amendments, Rules, & Regulations of the Veterans Administration (VA)
NFPA 72
NFPA 99
NFPA 101
NFPA 110

UL - Underwriters Laboratories

Refer to and comply with specific provisions under IDPH which reference different Code publication dates.

- B. Obtain approvals for installations requiring approval. Prints of the Electrical Drawings will be furnished on request. Required wiring diagrams shall be provided and submitted for approval by the Electrical Contractor. Copies of the final approved drawings shall be delivered to the Engineer. Approvals shall be obtained before commencement of related work.
- C. Pay fees and charges incidental to electrical work, including required insurance, permits, licenses and inspections. Arrange for inspections and deliver certificates of approval to the Engineer as a requirement for final payment.

1.4 VISITING THE SITE

- A. Bidders shall examine the site of the proposed work prior to bidding, so that they may fully understand the difficulties and restrictions attending the execution of the contract. No additional compensation will be allowed for failure to be so informed. Review the Drawings attached, so as to understand the type of construction, space limitations, etc., which will be encountered in construction.

1.5 COORDINATION OF WORK BETWEEN VARIOUS TRADES

- A. The Electrical Contractor shall be thoroughly informed of the intricacies of work which is to be performed by the General, Mechanical, Plumbing, and other Electrical Contractors. He shall perform his contractual obligations in full coordination with aforementioned trades. Prior to ordering of any electrical equipment, verify electrical characteristics of all mechanical equipment and inform the Architect/Engineer of all discrepancies. Claims for additional compensation will be denied due to failure to comply with the foregoing requirements.

1.6 SCHEDULING OF WORK

- A. Coordinate work with mechanical and general trades in order not to cause any delays in project progress schedule.
- B. Each electrical contractor will perform their work without affecting or disrupting normal hospital operations under any circumstances. Any shutdowns of systems or areas shall be done with authorization of Hospital Engineering, and shall be done during periods the foregoing authorities deem most advantageous to hospital operations. In case of any authorized shut-down of any system, portion of system or areas, the contractor shall be fully responsible to provide immediate restoration of this system, portion of system or area into full service, if necessary.

1.7 DEFINITIONS AND INTERPRETATIONS

- A. Specific terminology used in the Drawings and Specifications shall have the following meanings;
1. "Piping" includes pipe, fittings, couplings, hangers, supports, and other customarily required items required in connection with the transfer of electricity or data.
 2. "Install" includes unloading at the delivery point for the project and performing all tasks necessary to establish a secure mounting and correct operation, for items and assemblies furnished by other trades or the Owner.
 3. "Furnish" includes purchase and delivery to the project site, of items and assemblies, complete with necessary appurtenance.
 4. "Provide" shall mean "Furnish and Install".
 5. "Concealed" when used in connection with the installation of piping, shall mean hidden from view behind chases, furred spaces, pipe shafts, or above suspended ceilings.
 6. "Contractor" shall mean the Electrical Contractors and their vendors, fabricators or subcontractors.
 7. "Design Drawings" or "Contract Documents" shall mean documents, including drawings and written specifications, prepared by the Architects and Engineers, to obtain building permits and competitive bid proposals from contractors, for construction of the specified electrical systems.
 8. "Shop Drawings" shall mean documents, including calculations, drawings and material specifications prepared by the Electrical Contractors, obtaining approval from the authority having jurisdiction, Owner's Insurance Underwriter, Architect/Engineer.
- B. The following are industry abbreviations for plastic materials:
1. PVC: Polyvinyl chloride plastic.
- C. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 2. NBR: Acrylonitrile-butadiene rubber.
- D. The use of the Design Drawings and Specifications by the contractor, for Bid Proposal and Working Drawing preparation, shall include the following understanding:
1. The information included in the drawings and specifications is given as a guide only, to indicate general feasibility and to show an acceptable arrangement of systems, and equipment.
 2. The design drawings utilize symbols and diagrams to indicate required work, representing only the sequence of items to be installed, which have no dimensional significance and do not indicate every required item to be provided. The work shall be installed in accordance with the diagrammatic intent expressed on the drawings, in conformity with the dimensions indicated on the final architectural and structural working drawings, and final

equipment shop drawings. Information regarding general construction shall be derived only from the architectural and structural drawings and specifications.

3. The drawings and specifications are complementary and are to be utilized together for a complete interpretation of the work intended. The higher capacity or standard shall be provided, where conflicts between the drawings and specifications, or conflicts within themselves, occur.
4. The limitations of the language used on the drawings and specifications shall not be interpreted as meaning that accessories and appurtenances, required for completion of work, are to be excluded. The description of any item, on the drawings or in the specifications or both, requires the installation of all its necessary components for approved, satisfactory operation.
5. Submission of a bid proposal requires the contractor to review all project documents and visit the construction site, to be thoroughly familiar with all requirements for the project, and identify in his bid, conditions that may affect the efficient and satisfactory performance of the work. Claims for additional compensation shall be denied if the above procedures are not followed and the disputed conditions would have been identified by the completion of these required tasks.
6. The information shown on the design drawings and written in the specifications shall not be interpreted as to instruct the contractor to not follow the applicable codes or local amendments. Where the information provided for guidance is believed not to be in conformance with the code requirements and referenced standards, the contractor shall notify the Architect and Engineer for clarification prior to the submission of his bid proposal.

1.8 INGRESS AND EGRESS OF EQUIPMENT AND MATERIAL

- A. All openings, chases, and passageways into, out of or throughout the building shall be as indicated on the Architectural Plans. Where not indicated, required open ways for electrical work shall be provided by the Electrical Contractor.
- B. Coordinate the movement of equipment and material prior to the closing of open ways.

1.9 DRAWINGS AND SPECIFICATIONS

- A. The Contractor shall fully inform himself regarding all peculiarities and limitations of spaces available for the installation of materials and work provided under this Contract. Exercise due and particular caution to determine that all parts of the work shall be made quickly and easily accessible.
- B. The Contract Drawings accompanying these Specifications are to be considered important and integral parts of the same. Items omitted from one and contained in the other shall be furnished as if contained in both.

- C. Where conflicts in size, quantity or quality occur, the larger size, greater quantity, and superior quality shall govern and be furnished.
 - 1. The Contract Drawings shall serve as working drawings for the general layout of equipment. Layout of equipment, accessories, and specialties as shown are diagrammatic, and do not necessarily indicate every required junction box, pull box, and conduit routing, unless specifically dimensioned.
 - 2. It is intended that equipment shall be located symmetrically to site construction, notwithstanding the fact that locations indicated on the Drawings may be distorted for clearness in presentation.
 - 3. The Drawings indicate required size and points of termination, suggest proper routes to conform to structures, avoid obstruction and preserve clearances.

1.10 RECORD DOCUMENTS

- A. Provide AutoCad (CAD) drawings, minimum 1/8" scale plans or as outlined in the VA Specifications.
- B. Record Drawings shall show size, type, material, and equipment, location of outlets and source in building conduit, and communication systems.
- C. These Drawings shall also record the location of all underground services, and equipment by indication of measured dimensions to each such line from readily identifiable site elements.
- D. In preparation of shop drawings, contractor may, at his option, obtain from the engineer electronic drawing files in autocad format on a CD-ROM disk for shipping and handling fee of \$150.00 per request or as outlined in the VA Specifications. Contractor shall contact the architect and engineer for written authorization and necessary release authorization form and to specify shipping method. In addition to payment, architect's written authorization and engineer's release agreement form must be received before the electronic drawing files will be sent. Contractor shall include this cost in their bid.
- E. The Contractor shall submit letter of certification with pay request indicating that the record drawings on site are up to date and reflect true "as-built" conditions at that time. No pay request will be approved without this letter.
- F. The Contractor or Subcontractor shall keep at the project site one complete set of the Contract Working Drawings on which he shall record any deviations or changes from such Drawings made during construction. Record Drawings shall show change in size, type, capacity, etc., or material, device or piece of equipment, location of any outlet or source in building service system, rerouting any piping, or other building services.

- G. After the project is completed, three copies of these Drawings shall be delivered to the Owner in good condition as a permanent record of the installation as actually constructed, as a precedent to final payment.

1.11 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings submittal shall have a coordination sign-off signature from all disciplines.
- C. No material or equipment shall be purchased or installed without approved submittal.
- D. Electrical contractors shall obtain written approval from mechanical and plumbing contractor on product submittals.
- E. "As-Built" drawings shall include all the revisions done during the construction period.
- F. Electronic Submittals:
 - 1. Electronic submittals are preferred, but hard copy submittals will be accepted for review.
 - 2. Electronic submittals shall consist of pertinent information only, so as to minimize size of electronic files. Information that is not specific to the project will not be reviewed.
 - 3. Each category of product shall be submitted individually and shall be submitted in a separate email.
 - 4. Provide cover sheet with space for engineer's stamp.
 - 5. Provide transmittal sheet indicating section, title, and tag number as per table of contents of these specifications.
 - 6. All reviewed electronic submittals will be posted to K&A's ftp site (and architect's at their request)
 - 7. Shop drawings larger than 1 mb shall not be submitted by email.
 - 8. Installation manuals shall be distributed through the contractor and shall not be submitted for engineers review.
 - 9. Operation and maintenance manuals shall be submitted with project close out documents.
- G. Such submittals shall contain outline dimensions, operating and maintenance clearances and sufficient engineering data to indicate compliance with Specifications. Each submittal shall be clearly labeled with:
 - 1. Name of the job.
 - 2. Contractor's name and trade.
 - 3. The function of the item on which approval is required.
 - 4. Manufacturer's name.
 - 5. Subcontractor's name (if any).

6. Number of specification that item is being submitted under (i.e., Section 23 3416-2.08-A-4).

H. Review of Shop Drawings is rendered as a service only, and shall not be considered as a guarantee of measurements or building conditions, nor shall it be construed as relieving the Contractor of basic responsibility under the Contract.

I. Submit shop drawings, product data, and installation instructions for the equipment provided under this section and respective sections of the specifications.

J. Submit certifications per VA requirements

1.12 SUBSTITUTIONS

A. In accordance with the Architectural General Provisions and VA Specifications.

B. Substitutions submitted by the contractor shall be fully coordinated by said contractor for physical size, weight, equivalence to what has been specified. Contractor shall be responsible for the substitutions compliance to original design intent including voltage, amperage, energy usage, photometric equivalence, etc.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Support each request as follows:

1. Identify product by Specifications section and Article numbers.
2. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature; identify:
 - 1) Product description
 - 2) Reference standards
 - 3) Performance and test data.
 - c. Samples, as applicable.
 - d. Name and address of similar projects on which product has been used, and date of each installation.
3. Provide itemized comparison of the proposed substitution with product specified; list significant variations.
4. Data relating to changes in construction schedule.
5. Any effect of substitution on separate contracts.
6. List of changes required in other work or products.
7. Accurate cost data comparing proposed substitution with product specified.
 - a. Amount of any net change to Contract Sum.
8. Designation of availability of maintenance services, sources of replacement materials.

D. A request constitutes a representation that the Bidder and/or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same warranty for the Substitution as for the specified product.
 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 5. Will coordinate with other disciplines and include any and all costs and/or credits to other disciplines affected by the substitution.
 6. Will reimburse Owner for review or redesign services associated with re-approval by authorities.
- E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals; without separate written request, or when acceptance will require revision to the Contract Documents.
- F. Substitution Submittal Procedure:
1. Submit three copies of Request for Substitution for consideration. Limit each request to one proposed Substitution.
 2. Submit shop drawings, Product data, and certified test results attesting to the proposed Product equivalence.
 3. The Architect/Engineer will notify Contractor, in writing, of decision to accept or reject request.
- 1.13 CONTRACTOR'S SHOP DRAWINGS
- A. Shop Drawings and product data shall be submitted as directed under provisions of Architectural sections and VA Specifications.
- B. Electronic Submittals:
1. Electronic submittals are preferred, but hard copy submittals will be accepted for review.
 2. Electronic submittals shall consist of pertinent information only, so as to minimize size of electronic files. Descriptive catalog information or sales type brochures will be returned without review.
 3. Provide cover sheet with space for engineer's stamp
 4. Provide transmittal sheet indicating section and title as per table of contents of these specifications.
 5. Contractor shall submit electronic drawings to architect for distribution.
 6. Shop drawings larger than 1 mb shall not be submitted by email.
 7. All reviewed electronic submittals will be posted to K&A's ftp site (or architect's at their request) and the architect will be notified when it has been reviewed and can be retrieved.
- C. Review of Shop Drawings is rendered as a service only, and shall not

be considered as a guarantee of measurements or building conditions, nor shall it be construed as relieving the Contractor of responsibility under the Contract.

D. Electrical Contractor shall submit the following:

1. Product Data: Catalog cuts and technical information for all new electrical equipment including:
 - a. Circuit breakers
 - b. Fire alarm system
 - c. Overhead paging system
 - d. Lamps
 - e. Lighting equipment
 - f. Lighting fixtures, special or custom built
 - g. Nurse call system
 - h. Outlet boxes
 - i. Panelboard
 - j. Safety switches
 - k. Transformers
 - l. Wiring devices
 - m. Wiring device plates

- E. Contractor shall submit to Engineer for review, enlarged floor plans indicating layout of all electrical, generator and mechanical rooms that contain large electrical equipment. These drawings shall include panel boards, switch boards, transformers, ATS, etc. Plans shall reflect dimensions and locations consistent with submitted product data and shall indicate any HVAC, plumbing, medical gas and fire protection equipment, piping, ductwork, etc. located in these locations. These plans shall be submitted concurrently with the product data for a comprehensive review by the Engineer

1.14 STANDARDS FOR MATERIAL WORKMANSHIP

- A. Workmanship shall be in accordance with Division 1.
- B. All materials shall be new and shall conform with the standards of the Underwriters' Laboratories, Inc., in every case where such standards have been established for the particular material in question. All work shall present a neat, mechanical appearance when completed.
- C. Materials, the style, make or quality of which is specifically designated, shall be as specified. Should any substitution of material or item of equipment or apparatus be made, the Engineer's written approval must be obtained prior to installation.
- D. Furnish necessary materials in ample quantities and as frequently as required to avoid delay in the progress of the work, and so store them as to prevent interference with other work.
- E. All conduit shall be run parallel to lines of the building unless otherwise distinctly shown or noted in the Drawings.
- F. Conduit shall be concealed where possible.

- G. Hangers shall be supported from rods fastened to building construction. Wire or perforated strap iron will not be permitted.
- H. Where head room requirements or physical space limitations necessitate, consideration shall be given to altering of building structural elements such as penetrating beams, webs, notching of joists, etc., which shall be kept to an absolute minimum, and shall be done only after written permission is issued by the Architect and/or Structural Engineer. Any damage done to structural or architectural elements shall be restored and/or repaired to the satisfaction of the Engineer at the expense of the installer. Refer to Section 01045 Cutting and Patching.
- I. All piping, equipment, devices, hangers, etc., shall be securely and permanently hung from supporting walls, roof or floor construction etc., in a manner satisfactory to the Architect and Engineer.
- J. All material or work found to be defective or not in strict conformity with the Drawings or different from the requirements of the Drawings and Specifications, or defaced or injured through negligence of the Contractor or his employees, or through the action of fire or weather or any other cause, will be rejected and shall be immediately removed from the premises by the Contractor and satisfactory material and work substituted therein without delay.
- K. Any defective material or work which may be discovered shall be corrected immediately on notice from the Engineer. No previous inspection or certificate on account shall be held to relieve the Contractor from his obligation to furnish sound material and to perform good and satisfactory work.

1.15 MATERIAL

- A. All materials shall be new and shall conform with the standards of the Underwriters' Laboratories, Inc. All work shall present a neat, appearance when completed.
- B. Materials, style, make or quality of which is specifically designated, shall be provided. Should any substitution of material be made, the Engineer's written approval must be obtained prior to installation.
- C. Furnish necessary materials in ample quantities and as frequently as required to avoid delay in the progress of the work.
- D. Conduit shall run parallel to lines of the building unless otherwise distinctly shown or noted in the Drawings.
- E. Where physical space limitations necessitate, consideration shall be given to altering of building structural elements such as penetrating beams, webs, notching of joists, etc., and shall be done only after written permission is issued by the Architect and/or Structural Engineer. Any damage done to structural or architectural elements shall

be restored to the satisfaction of the Engineer/Architect at the expense of the installer.

- F. Electrical equipment, devices, etc., shall be securely and permanently hung from supporting walls, or roof construction, in a manner satisfactory to the Architect and Engineer.
- G. Material or work found to be defective, not in strict conformity with the Drawings and Specifications, defaced, or injured shall be immediately removed from the premises and new material and work provided without delay.
- H. Defective material or work shall be corrected immediately on notice from the Engineer/Architect. No previous inspection or certificate on account shall be held to relieve the Contractor from his obligation to furnish sound material and to perform satisfactory work.

1.16 MANUFACTURER'S NAMEPLATES

- A. Major components of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable.

1.17 LINES AND LEVELS

- A. Electrical Contractor shall be responsible for lines and levels of lighting fixtures, panels and conduit, based on reference lines and bench marks established by the Contractor for the general work.

1.18 RULES AND REGULATIONS

- A. All workmanship and materials shall conform with the requirements of the building and ordinances and rules and regulations of all departments and bureaus of the County, City and State having lawful jurisdiction, irrespective of any statements herein to the contrary.

1.19 ORDINANCES

- A. The work shall be in accordance with the governing State and Local ordinances, codes and regulations; including fire rating and inspection bureaus and the N.F.P.A. regulation, all of which are hereby made a part of these Specifications.

1.20 GUARANTEES

- A. Furnish guarantees as per Architectural General Provisions and as follows:
- B. Guarantee work, materials and equipment against defects for a period of one year from the date of substantial completion. Repairs or replacements made under the guarantee shall bear an additional twelve (12) month guarantee from date of repair or replacement. Provide all service necessary to the proper performance of the system for a period

of one (1) year from the date of substantial completion of the contract at no additional charge to the Owner.

- C. Submit product warranties on equipment including any extended warranties. Identify all warranties with specification section number and equipment identification number.

1.21 HOUSEKEEPING

- A. Furnish cleaning as per Architectural General Provisions and as follows.
- B. Keep stocks of materials and equipment stored on the premises in a neat and orderly manner.
- C. Exposed surfaces of electrical equipment which has become covered with dirt, plaster, or other material during handling and construction, shall be thoroughly cleaned.

1.22 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and protect materials and equipment under Division 01.
- B. Any fixtures, equipment or apparatus delivered to the project and stored on the project exposed to the weather, shall be completely covered with a minimum 6 mil white polyethylene sheets.

1.23 ACCESS PANELS

- A. Ceiling, duct chase, and pipe chase access panels will be installed by General Contractor where indicated and as required for access to valves, dampers, apparatus, etc. Where access panels are required, but are not shown on the drawings, their omission shall be brought to the attention of the Architect/ Engineer, and coordinated with other trades for quantity, size, location and installation of additional panels as approved by the Architect/Engineer.

1.24 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for electrical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

1.25 CHANGE PROPOSAL REQUESTS

- A. All Change Proposal Requests for work additional to the base bid contract shall be based on material, labor, overhead and profit costs as published in the latest edition of "Means Mechanical, Electrical, Plumbing, and Building Construction Cost Data". All change requests must be broken down in the following manor:
- Material cost: (ie. Equipment, sheet metal per pound and piping per lineal foot/fitting).
- Labor cost: (Number of hours at current labor rate per hour)
- Overhead and profit: (Indicating percentages)
- Total change order price: (Material + labor = O&P)
- Pricing for all items of work which are to be credited to the project shall be broken down in a similar manor to the added costs.
- The associated cost for drafting changes (including three dimensional modeling) shall not exceed 10% of the cost of material and labor for the change.

1.26 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Furnish to the Owner three (3) manuals covering model, type, serial numbers, capacities, flow, operation and maintenance of each major item of equipment or apparatus. Operation instructions shall cover all phases of control.

1.27 FINAL PAYMENT

- A. Final payment shall be withheld until all items of deficiency are corrected and accepted, and complete sets of reproducible "as-built" record drawings are received from each sub-contractor for their work.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.1 PREPARATION

- A. Determine the related work in place is free of conditions which might be detrimental to proper and timely completion of the work. Start of work shall indicate acceptability of the related work.

3.2 INSTALLATION

- A. Electrical Drawings, which accompany these Specifications, show the work to be installed and shall be followed as closely as actual construction will permit. Changes from the Electrical Drawings necessary to make the electrical work conform to the site plan and to fit the work of other trades shall be made without extra cost.
- B. Give careful consideration to clearances under beams, over windows, etc. to provide maximum headroom in all cases, and to the locations of

lines and type of fittings used to obtain these clearances. Ascertain from the drawings the heights of all suspended ceilings and the size of all shafts in which work is to be concealed, and the location and size of structural members in and adjacent to all shafts. Coordinate the work with all other equipment. In any case, where insufficient room is provided for piping above suspended ceilings, or in vertical shafts, obtain clarification from the Engineer before any work is installed.

- C. Refer to equipment shop drawings of equipment being furnished under other sections for exact location of outlets and electrical connections required.
- D. Before making any installation, make necessary and proper arrangements for changes required to avoid interference with on other systems.
- F. Where electrical work is required for connection to equipment furnished under other sections, verify electrical requirements in the field and make proper connection to such equipment.
- G. Where existing areas are being demolished and will be occupied or accessible during construction, provide temporary lighting (normal and egress), fire alarm, life safety equipment, etc. for safe continued use of the space until construction is complete.
- H. Provide temporary power as required to ensure existing circuits remain operational during construction.

3.3 CUTTING

- A. All cutting required for the installation of electrical work shall be by the electrical contractor.

3.4 SLEEVES

- A. Provide sleeves and openings for exposed conduits, and wireways where they pass through walls or floors.
- B. Pack or fill sleeves and openings after the completed work is in place. Filling shall provide a waterproof and fireproof packing to prevent leakage of liquid, smoke, or fire through the sleeve or opening. Fire proofing compound shall be UL listed and equal to the fire rating of the surrounding construction.
- C. Where conduits pass through foundation walls, provide entrance seals, link seal type "WS", and type "LS" or 0.2 Gedney type "WS" and type "LS" or 0.2 Gedney type "WSK" or "CM" as applicable.

3.5 EQUIPMENT NOISE LIMITATION

- A. Noise levels of electrical devices and equipment shall be within acceptable limits as established by NEMA or other valid noise rating agencies. Noise levels shall be subject to the Engineer's acceptance,

based on practical and reasonable consideration of occupancy requirements.

- B. Check and tighten the fastenings of sheet metal plates, covers, doors, and trims to prevent vibration and chatter under normal conditions of use.
- C. When located elsewhere than in high noise level equipment rooms, the enclosures of solenoid-operated switching devices and other noise producing devices shall have anti-vibration mountings and non-combustible sound absorbing linings.

3.6 LOCATION OF WIRING AND OUTLETS

- A. Coordinate the work with all trades involved so that exact locations may be obtained for apparatus, appliances and wiring.

3.7 TRANSMISSION OF VIBRATION

- A. Electrical equipment, conduit and fittings shall not be mounted to elements subject to vibration. Where flexible lengths of conduit are utilized, as a means of isolating equipment and conduit systems, provide additional ground wire and clamps for proper ground continuity.

3.8 MOUNTING HEIGHTS

- A. Mounting heights of electrical items shall be as per the architectural drawings, elevations and details, unless otherwise indicated by the Engineer/ Architect's field instructions. Dimensions are above finished floor.

3.9 EQUIPMENT IDENTIFICATION

- A. Provide permanent identification markings for each item of electrical apparatus and associated controlled equipment, with the same inscriptions as shown on the Drawings, or as directed. Confirm all nameplates and schedules prior to ordering.
- B. Provide paint stenciled inscription markings on the outside and inside face of each feeder splice box, junction box, and pull box cover plate indicating feeder size, voltage, phase, and load served.
- C. Apply engraved plastic laminate name plates with non-corroding screw fasteners or rivets to all panelboards. Name plates shall be white with black core, 1-1/4" x 3" minimum.
- D. Provide typewritten directory of circuits in panels and provide panel identification in black alkyd paint stenciled inscriptions on the inside of the door, directly above the center line of directory frame, or on vertical and horizontal center line of doors without directory frames.

- E. Provide on device plates for toggle switch type manual starters, pilot lights, motor starters, and other electrical items whose function is not readily apparent, or plastic laminate name plates describing the equipment controlled. Embossed self-adhering plastic tape labels will not be accepted. Each wire and each cable shall be labeled at terminals and at all accessible points in equipment and panelboards. Labels shall be self-sticking wire markers.
- F. Paint all fire alarm system junction boxes, pull boxes, etc., red.
- G. Provide schedule of nameplates for approval.
- H. Identify all emergency circuits, pullboxes, etc. See respective specification sections.

3.10 OPERATING TESTS

- A. Upon completion of the electrical work, place the entire installation in operation. Test for proper function and show systems and equipment to be free of defects. Motors and driven equipment shall not be run until properly lubricated.
- B. Refer to VA Specifications for additional testing requirements.
- C. Testing shall be as follows:
 - 1. After wires are in place and connected to devices and equipment, the system shall be tested for shorts and grounds.
 - 2. All hot wires, if shorted or grounded, shall be removed and replaced.
 - 3. A voltage test shall be made at the last outlet on each circuit. If drop in potential is excessive, Contractor will be required to correct the condition.
 - 4. All grounds, shorts and high resistance splices shall be rectified.
 - 5. Any wiring device, electrical apparatus or lighting fixture furnished under this Contract, if grounded or shorted on any integral "live" part, shall be removed and the trouble rectified by replacing all defective parts or materials as directed.
 - 6. Service ground to be tested per National Electrical Code requirement. Grounding pole of all receptacles to be tested.
 - 7. All motors shall be tested under load with ammeter reading taken in each phase, and the RPM of motors recorded at the time. All motors shall be tested for correct direction or rotation. Electrical Contractor shall be responsible for testing running of all motors and shall verify that proper overload devices have been installed.
 - 8. All meters, instruments, cable connections, equipment or apparatus necessary for making all testing, shall be furnished by this Contractor at his own expense.

- D. One month after the turn-over of all project spaces, the Electrical Contractor shall perform a (30) day meter reading on all emergency branches affected by this project. Each transfer switch shall be measured for the period of (30) days at increments not greater than one minute, by a Fluke (or equivalent) recording meter on the load side of each transfer switch. The following shall be measured: phase and neutral peak/avg/min voltages, amperage and frequency. The Contractor shall provide the Owner with a data output file and hardcopy of the readings for record. The Contractor shall obtain the required recording equipment to simultaneously record all transfer switches.

3.11 LOCATION OF EQUIPMENT AND DEVICES

- A. Locations of equipment and devices are approximate. Where equipment and devices are exposed to public view the exact locations are as shown on the Architectural drawings, approved coordination drawings, and approved shop drawings. In all cases, consult with the Architect when the exact location is in doubt.
- B. Prior to rough-in, relocate equipment when directed by Architect/Engineer without cost.

3.12 COORDINATION

- A. Prior to the start of electrical work, the electrical contractor shall review the mechanical contractor's shop drawings and coordinate the conduit and box layout with the mechanical contractor's piping and ductwork shop drawings, including fire protection.
- B. Care shall be taken to maintain code required clearances above and in front of all electrical equipment.

END OF SECTION