DIVISION 16 ELECTRICAL

SECTION 16010

GENERAL REQUIREMENTS

PART 1 – GENERAL EXTENT OF WORK

1.01 The General Conditions, General Requirements, and Special Conditions shall be and are hereby made a part of this section. The Electrical Contractor shall furnish all labor, materials, tools, transportation, equipment, services and facilities required for the complete, proper and substantial installation of all electrical work shown on the drawings and/or outlined in these specifications. The installation shall include all materials, appliances and apparatus not specifically mentioned herein or noted on the drawings, but which are necessary to make a complete working installation of all electrical systems.

1.02 The Contractor shall consult and be guided by the General Conditions and all other divisions referred to herein and relative thereto in performing the work covered under this division of the specification.

1.03 All of the electrical related work required for this project (unless specified otherwise) is a part of the electrical contract price and is not necessarily specified under this division of the specifications or shown on the drawings. Therefore, all divisions of the specifications and all drawings shall be consulted.

1.04 The drawings showing the layout of the work indicate the approximate locations of outlets, apparatus and equipment. The drawings are schematic only and are not intended to show the exact routing of conduits, etc. The field determination as to the routing shall be governed by structural conditions and other obstructions. This shall not be construed to mean the design of the system may be changed, it merely refers to the exact run of a raceway between given points. The Contractor shall consult all contract drawings which may affect the location of outlets, apparatus or equipment to avoid possible interference and permit full coordination of all work. The right to make any reasonable change in the location of apparatus, outlets and equipment up to the time of roughing-in is reserved by the Architect without involving any additional expense to the Owner.

1.05 The approval by the Architect or his representative of any materials, drawings, etc., submitted by the Contractor will be considered as general only and to aid the Contractor in carrying out his work. Such approval as may be given does not relieve the Contractor from the necessity of furnishing the materials and performing all the work as required by the drawings and the specifications.

1.06 The work specified under this division of the specifications shall include the furnishing of all labor, materials, apparatus and tools necessary for the complete installation of all conduit and wiring; devices for lighting, power and control systems, and such other work and equipment as are indicated on the drawings or as noted herein.

1.07 The entire installation shall be made in a workman like manner, left completely connected, and ready to give proper and continuous service.

1.08 All materials and work in connection with the foregoing items shall be as specified herein, or called for on the drawings.

1.09 The complete installation shall be in accordance with the latest rules and regulations of the National Fire Protection Association and all other Boards and Departments having jurisdiction. Any items or requirements noted herein or shown on the drawings in excess of code requirements, but permitted under the code, shall be in accordance unless special permission is obtained from the Architect to the contrary.

1.10 The light and power installation shall operate with the electrical energy obtained from outside sources. Such part of the system as may be required by rules of the local utility company shall, insofar as method of construction, workmanship and materials are concerned, be in full accordance with the standard practice and rules and regulations of the local utility company.

1.11 This Contractor shall coordinate his work under this division of the specifications with the work of other trades wherein it may be interrelated. His work shall be done in such an order that there will be no interference in installing, nor delay in completion, of any part or parts of each trade, insofar as progress is permitting all construction work to proceed in its natural sequence without unnecessary delay.

1.12 Before submitting his bid, the Contractor shall familiarize himself with the rules of all governing bodies having jurisdiction and shall notify the Architect in submitting his bid, if in his opinion, any work or material specified is contrary to such rules. Otherwise, the Contractor shall be responsible for the approval of all work and materials and, in case the use of any material specified is not permitted, a substitute shall be approved by the Architect and shall be provided at no increase in cost.

1.13 Unless noted otherwise on the Drawings, or elsewhere in these Specifications, the singular words 'Provide', 'Furnish', or 'Install' noted on the drawings or in these Specifications shall mean to completely furnish, install, and connect each item, and if such is a part or component of a system the entire system shall be functional with all items and components provided.

PART 2 – RULES AND REGULATIONS

2.01 All work under this heading shall comply with the latest rules and regulations of the National Electrical Code Standard of the National Fire Protection Association and with all laws, regulations and ordinances of the utility company, City, County and State.

2.02 Drawings and specifications indicate the minimum standards of construction. Should any work indicated be substandard to any ordinance, law, code, rule or regulation bearing on work, the Contractor shall execute work accordingly, without increased cost to the Owner, but not until he has entered such variances to the Architect for his approval.

2.03 This Contractor shall provide and install only the brands of materials and equipment specified herein, or equipment approved by the Architect–Engineer as equal. All material and equipment shall be listed and labeled by Underwriters Laboratories, Inc., indicating compliance with nationally recognized standards and/or tests.

PART 3 – PERMITS, FEES AND INSPECTIONS

3.01 Secure and pay for all necessary and usual permits, fees, inspections and certificates required for this work and deliver permits and certificates to the Architect for transmittal to the Owner before final acceptance of the project.

PART 4 – SERVICES

4.01 This Contractor shall pay for all expenses, deposits, reimbursements, etc., required by the local rules and codes for the service to the building, complete and ready for use.

4.02 This Contractor shall bear all expenses involved for the complete installation of the electrical service (both temporary and permanent) to the building ready for operation, except as specifically excluded on the drawings. All temporary wiring shall be installed per the National Electrical Code. This shall include guard posts around transformers and pedestals per utility company standards. Verify complete installation and locations of pad mount or pole mount transformers with the local electric utility company and bid installation to comply with their requirements.

4.03 This Contractor shall consult all local departments to verify requirements and bid installation of service in accordance with local codes and utility company standards.

4.04 This Contractor shall bear all expenses involved for the complete telephone service conduit installation and steel or nylon pull wire ready for cable installation. Verify complete installation with the local telephone company and bid installation to comply with their requirements.

PART 6 – MATERIALS OF APPROVED EQUAL

6.01 Where items of equipment and/or materials are specifically identified herein by a manufacturer's name, model or catalog number, only such specific items may be used in the base bid, except as hereinafter provided.

6.02 Unless requests for changes in base bid specifications are received and approved and noted by written addendum prior to the opening of bids, the successful contractor will be held to furnish specified items.

6.03 After contract is awarded, changes in specifications shall be made only as defined under "Substitution of Equipment."

PART 7 – SUBSTITUTION OF EQUIPMENT

7.01 After execution of the contract, substitution of equipment of makes other than those specifically named in the contract documents may be approved by the Engineer only if the equipment named in the specifications cannot be delivered to the job in time to completethe work in proper sequence to work of other contractors, due to conditions beyond control of the contractor.

7.02 Requests for substitutions must be accompanied by documentary proof of equality of difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.

7.03 The Owner shall receive all benefits of the difference in cost involved in any substitution, and the contract uitered by change order to credit Owner with any savings so obtained.

PART 8 – SUBMITTALS

8.01 Contractor shall, within 15 days after award of contracts begin sending to the General Contractor for review submittals containing the following:

8.02 Shop Drawings:

A. Submit three master sets of "Shop Drawings" in the form of bond paper 8 1/2" x 11" or 11" x 17" size. Data shall be reduced on drawings as required to leave 5" x 3" clear on each drawing for Engineer's stamp.

B. Architect and consultants will retain copies of the master set for their records and return one reviewed master set to the contractor.

C. Contractor(s) shall, upon receipt of reviewed shop drawings, distribute and distribute copies of reviewed master set as necessary to coordinate work. (Contractor's file, job site file, record document file, other prime contractors, subcontractors and suppliers.)

D. Shop Drawings are custom prepared data and shall show and identify item(s) to be furnished and give location, arrangement, scale, details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, finish and other pertinent information. Each individual item shall have its own separate sheet unless noted otherwise. (Example: Separate sheets for each panelboard.)

E. All shop drawings shall be checked and signed by this contractor and General Contractor prior to submittal to the Architect/Engineer. SHOP DRAWINGS SUBMITTED WITHOUT THE CONTRACTOR'S STAMP OF APPROVAL AND VERIFICATION WILL BE RETURNED BEFORE THE ENGINEER WILL REVIEW SAME.

Equipment, materials, etc., not meeting specifications and/or drawing requirements shall be returned to the supplier for corrections before they are submitted to the Architect–Engineer. This Contractor is reminded that only those materials specified, approved or otherwise indicated by the project specifications, drawings, or addenda will be permitted to be used in constructing the electrical work for this project. The first review of submittals (shop drawings) will be provided as indicated at no charge to the Contractor However, subsequent review(s) of resubmittals required by 'Rejected' status from the original review will necessitate the Electrical Contractor being charged by the electrical consultant a fee of $65 per man–hour, with a minimum charge of $100 for each item resubmitted. It is intended that all electrical submittals be made in a complete and timely fashion such as to permit a comprehensive and thorough review of same.

F. Each shop drawing sheet shall indicate job name.

G. Shop drawings submitted without contractor's signatures or approval and verification will not be reviewed.

H. Shop drawings shall be submitted on wire, devices, fixtures (including distribution curves), gear, systems, conduit, etc.

8.03 Product Data: Product Data includes manufacturer's printed specifications, instructions, recommendations, pertinent catalog sheets and similar information. Such data shall be marked to identify the item applicable to the Project. Submit three copies. Architect and consultants will review, note and record action and make copies for their files. One submitted copy then will be returned to the Contractor who shall reproduce and distribute copies needed for Project Work.

8.04 Quantities of materials will not be verified by the Architect or Engineer. Submittal Review stamp on shop drawings does not constitute review of quantities listed on shop drawings.

8.05 Engineer's review of Compliance Submittals will not relieve Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless Contractor, has in writing, called Engineer's attention to such deviation at the time of submission and Engineer has given written approval to the specific deviation, nor shall any review by Engineer relieve Contractor from responsibility for errors and/or omissions in Compliance Submittals. No work shall be fabricated until the Architect's review has been obtained. Any time delay caused by rejecting and resubmitting shop drawings will be the responsibility of the Contractor.

PART 9 – OPERATING INSTRUCTIONS:

9.01 The Contractor shall submit along with the shop drawings of the equipment, three (3) copies of operating instructions for all items. Instructions shall be prepared by the manufacturer of the equipment.

9.02 After the operating instructions have been approved by the Engineer, the Contractor shall frame one (1) set under plastic and mount near the equipment described.

9.03 The Contractor shall also obtain all manufacturer's instruction manuals and provide one complete set of "as built" drawings and turn these over to the Architect upon completion of the project.

9.04 The Contractor shall keep in a safe place all keys and special wrenches furnished with equipment under this contract and shall give same to the Architect at the completion of the project.

9.05 The Contractor shall prepare (5) complete brochures covering all the equipment furnished and installed under this contract. Brochures shall be submitted to the Architect–Engineer for review prior to delivery to the Owner. The Engineer will retain (1) copy. The cost of these brochures shall be included in the contract cost. Brochures shall contain the following:

A. Certified equipment drawings and/or catalog data clearly marked for equipment furnished as required for approval submission under previously detailed section of these specifications.

B. Complete operating and maintenance instructions for each item of equipment.

C. Complete parts list for each equipment item.

D. Any special emergency operating instructions and a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of the system.

E. Riser diagrams on special systems.

9.06 Brochures shall be bound in hard fiberboard covers or loose–leaf binders. If loose–leaf binding is used, each sheet shall be reinforced to prevent tearing from continued usage. Each brochure shall have the following information clearly printed on its front cover:

A. Project name and address.

B. Section of work covered: "Electrical Work".

C. Name and address of Architect.

D. Name and address of Engineer.

E. Name and address of Contractor.

F. Telephone number of Contractor, including night or emergency number.

9.07 In addition to these written instructions, each respective Contractor shall fully and carefully instruct the Owner, or his representatives, as to the proper operation, care and maintenance of each system and its equipment.

ART 10 – COORDINATION AND BUILDING DETAILS

10.01 The Contractor shall visit the site and determine all existing local conditions affecting work in his contract. He shall examine architectural drawings and specifications to familiarize himself with the type of construction to be used for all work and how it will effect the installation of work in his contract.

10.02 Failure to determine existing conditions or the nature of existing or new construction will not be considered as a basis for the granting of additional compensation.

10.03 The drawings have been prepared to cover all electrical work under this contract. The Contractor is referred to all other contract drawings to guide him in the proper installation of his work.

10.04 The Contractor shall fully familiarize himself with the floor drawings, elevations, details of construction, feeders, fixtures, conduit, wiring, service, etc., insofar as it may effect the installation of the work under this specification in order that all necessary materials and labor may be provided even though not specifically referred to on the drawings or called for in the specifications.

10.05 As the drawings are generally diagrammatic, the final layout of the work shall be subject to the approval of the Architect but the Contractor shall be responsible without increase in contract price for the coordination of all work under various divisions of the specifications.

10.06 This Contractor shall confer with other Contractors installing work in this building and, in his work, must arrange his conduit, etc., in proper relation to such work. Any damage resulting from his neglect to do so must be paid for by the Contractor.

10.07 Where necessary to fit and center with paneling of ceilings and wall spaces, the Contractor must, at his own expense, shift locations of outlets or other outlets as required by the Architect.

10.08 All outlets shall be set in such a manner as to finish flush with wall and ceiling lines unless marked to be exposed or surface mounted on the drawings. The height of brackets, switches, outlets, etc., are to be as directed.

10.09 The Contractor shall obtain from the Architectural and Structural drawings the exact location and size of spaces available for his apparatus and material and shall install them accordingly. In case the space allowed is not sufficient, or an obstruction interferes with placing them as shown or specified, the Contractor shall obtain instructions from the Architect and shall install them as directed without extra charge.

10.10 The above provisions refer only to the exactness of positions that cannot be determined from the drawings and do not permit changes in locations distinctly different from that shown on the drawings.

10.11 This Contractor shall do all cutting and patching of building materials required for the installation of work herein specified. No structural member shall be cut without the approval of the Architect and such cutting shall be done in a manner directed by him.

10.12 All patching shall be done in a neat and workman–like manner, meeting with the approval of the Architect, by mechanics of the particular trade involved. Any penetrations through roof shall be done with "Stoneman" flashing connections as manufactured by Stoneman Engineering and Manufacturing Co., Inglewood, Calif., and any penetrations made in exterior or basement foundation walls shall be sealed with Thunderline "Link–Seal" connections, as manufactured by Thunderline Corporation, Wayne, Michigan.

10.13 Any holes or voids created in floors, ceilings and walls, including any spaces or gaps around conduit or equipment passing through such areas, which compromise the applicable rating of the floors, ceilings or walls, shall be sealed with an intumescent material equal to "3M Fire Barrier Caulk, Putty or Strip Sheet", "Carborundum Fiberfax Fyre Putty", "Tremco X–Tenn Fire Products", or "Redorseal Metacork"; which meets the above and meeting U.L. 1479 may be used. All installations shall be per manufacturer's exact instructions.

10.14 All drilling of holes through concrete shall be accurately and carefully done by using a "Concrete Permite" drill. The use of a star drill or of hammer for this work shall not be permitted.

10.15 This Contractor shall do all painting and finishing of all electrical equipment installed in finished areas. All work shall be performed in accordance with the Architectural specification section on "Painting and Finishing". All colors and finish applications shall be as directed by the Architect. (Painting is not required of receptacles, switches, circuit breakers, etc., unless specifically so noted on the drawings.)

10.16 The Electrical Contractor shall confirm the exact electrical requirements for all equipment supplied by others and installed or connected by the Electrical Contractor. The specific work performed for the installation of any equipment shall be in conformance with the requirements established by the shop drawings of the equipment supplied. In the event the shop drawings establish requirements distinctly different than the requirements shown in the contract documents, the Contractor shall be entitled only to an adjustment of the difference between the work shown and the work required with full credit for labor and materials shown on the original drawings.

10.17 The Electrical Contractor shall provide all trenching and backfilling for underground conduits. Unless noted otherwise in other divisions of these specifications, all trenches shall be backfilled and compacted with material defined by the United Soil Classification as ML or CL (silt and clay of low to medium plasticity). Compaction shall be to 90% of ASTM D698.

PART 11 – PERFORMANCE

11.01 Provide as part of the work of this contract, in addition to the first year guarantee on equipment and materials, the following described routine maintenance and inspection. (The one year time period will not start until each and every item is complete in accordance with drawings and specifications and accepted by the Owner). Check all emergency systems, control, fire alarm, transformers, etc., correct and adjust same. This service to be provided during the guarantee period.

PART 12 – SYSTEM

12.01 Systems: Distribution characteristics shall be as indicated on drawings.

PART 13 – GROUNDING

13.01 All conductors, motor frames, etc., that require grounding shall be grounded in accordance with the requirements of the National Electrical Code, local power company and local electrical codes. All ground connections to ground rods shall be with U.L. approved ground clamps. Provide additional ground rods as required to achieve a resistance of 25 ohms or less per N.E.C. 250–84; at the request of the Engineer provide a copy of the ground test results. Multiple ground rods (when required) shall not be less than 6 feet apart.

PART 14 – ADJUSTING, ALIGNING AND TESTING

14.01 All equipment shall be checked for proper adjustment and balance. All panelboards, distribution panels, switchboards, and transformers shall be balanced to provide a balanced load on each phase. A complete record of all such adjustments shall be made. Final readings shall be submitted to the Architect–Engineer for records. The Contractor shall provide all equipment, instruments, gauges, meters, etc., as required for the complete checking of these systems.

14.02 Mechanisms of all electrical equipment shall be checked, adjusted, and tested for proper operation. Adjustable parts of all lighting fixtures and all electrical equipment shall be checked, adjusted, and tested as required to produce the intended performance.

14.03 Completed wiring system shall be free from open or shorted circuits. After completion, this Contractor shall perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.

14.04 The Contractor shall maintain service and equipment for the testing of electrical equipment and apparatus until all work is approved and accepted by the Owner. A first class voltmeter and ammeter shall be kept available at all times and this Contractor shall provide service for test readings when and as required. All test readings shall be recorded on an approved form and submitted to the Architect.

14.05 Before final acceptance is made, this Contractor shall, at his own expense, make proper distribute the sequence of operations of the sound system, controls, fire alarm, etc., for each and every item requiring instructions. These instructions shall be mounted as directed. He shall cover same with Architect and/or his selected parties, and shall adjust all apparatus and place same in satisfactory operating service as approved by the Architect.

14.06 Final observation will be made upon written request from the Contractor after the project is complete. At the time of final observation, the Contractor shall be present or shall be represented by a person of authority. The Contractor shall temporarily operate, as directed by the Architect–Engineer, that his work fully complies with the purpose and intent of the drawings and specifications. All labor, services, and all instruments necessary for such demonstration and tests shall be provided by the Contractor.

PART 15 – MOTOR CONTROL AND SPECIAL CONNECTIONS

15.01 The Electrical Contractor shall furnish, install and connect all wiring, conduit, boxes, toggle switches, thermal switches, disconnect switches, remote push–button stations and relays included in magnetic starters, etc., for all equipment requiring electrical power that is furnished by other contractors and/or the Owner, as required for a complete and satisfactory job. The Electrical Contractor shall receive, install and connect all magnetic starters and controllers, capacitors, power factor correction devices, transformers, alarms, bells, horns, relays, remote switches, etc., for equipment supplied by others. (i.e.: capacitors, power factor correction devices for mechanical equipment, etc.). In general all major equipment will be specified to be factory prewired with only a minimum of external interlocking required at the site by the Electrical Contractor; however it shall check all divisions of the specifications to verify if the equipment is specified factory prewired and if not, then it shall be the responsibility of the Electrical Contractor to provide the complete wiring of the equipment in accordance with the wiring diagrams and temperature control drawings provided by the other contractors and/or the Owner, to the Electrical Contractor. All interlocking of equipment shall be by the Electrical Contractor.

15.02 All control equipment requiring piping connections to air, water, steam, etc., such as pneumatic valves, electric relays, remote bulb temperature controls, solenoid valves, aquastats, pressure control, etc., will be furnished and installed under the mechanical work.

15.03 All line and low voltage wiring, conduit and connections required to control equipment and/or dampers are a part of this section. Provide and install line or low voltage wiring to all dampers as required for system operation. All low voltage wiring, conduit, connections and/or terminations are by the Electrical Contractor unless specifically noted otherwise within the bidding documents.

15.04 It shall be assumed the Contractor has familiarized himself with the equipment to be furnished by the other contractors and/or the Owner in connection with this work and that provisions for such connections and work have been included in the Contractor's price. In no case will extra remuneration be allowed for such work.

15.05 Connections to all equipment have been designed for units as specified on the drawings or in the specifications. In the event equipment or controls differ on approved mechanical list, it shall be the sole responsibility of the supplying contractor to coordinate electrical connections to the units and reimburse Electrical Contractor for any changes in system design. These changes shall not involve additional cost to the Owner.

PART 16 – GUARANTEE

16.01 This Contractor, by the acceptance of this specification and the signing of his contract, acknowledges his acquaintance with the requirements and guarantees that every part used in constructing the system as herein described will be of the best of its respective kind that can be obtained and will be erected in a most thorough and substantial manner by none but experienced workmen.

16.02 He guarantees that all conduit as provided within and by this specification will be free from all obstructions of every description and will be free from holes or broken places and be well bonded together. He guarantees that all wiring and conduit to be used in construction of this project will be new and unused.

16.03 He further guarantees to hold himself responsible for any defects which may develop in any part of the entire system, including apparatus and appliances provided under this section of the specification, and to replace and make good without cost to the Owner any such faulty parts of construction which develop defects at any time within one year from date of final certification of completion and acceptance. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problem cannot be rectified immediately to the Owner's satisfaction, advise Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Architect will then suggest course of action. The Electrical Contractor shall replace material and equipment that requires excessive service during the guarantee period as defined and as directed by the Architect. This guarantee does not include ordinary lamp failure.

16.04 Use of systems provided under the Specification for temporary services and facilities shall not constitute First Acceptance of the work or shall not use by the Owner, and shall not institute guarantee period.

PART 17 – SUPPLEMENTARY CONDITIONS

17.01 Supplementary to all other terms of the contract, this work shall be performed subject to the following conditions.

17.02 Materials and equipment installed on this project shall be first class in quality and shall be new and unused.

17.03 Workmanship on this project shall be first class work performed by the experienced licensed mechanics of the proper trade.

17.04 Work under this contract shall be adequately protected at all times. Temporary raceways shall be kept closed and all raceways shall be installed clean and free from dirt and grease.

17.05 Storage, parking, signs, advertisement, fires and smoking shall conform to all applicable regulations and/or directions of the Architect.

17.06 Measurements on job and shop layouts required for installation of work shall be the responsibility of the contractor ordering the work is subject to approval of shop drawings by the Architect.

17.07 Contractor shall furnish all hoists, scaffolds, staging, runways and equipment necessary for the completion of this work.

17.08 Obtain and pay for all required electrical permits and licenses.

17.09 Maintain lights and guards required for safety.

17.10 Remove temporary service after use.

PART 18 – CONTRACT CHANGES

18.01 All changes or deviations from the contract, including those for extra or additional work, must be submitted in writing for the approval of the Architect/Engineer. No verbal orders will be recognized.

PART 19 – RUBBISH/CLEANUP

19.01 All rubbish resulting from the work herein specified shall be periodically removed by this Contractor.

19.02 Clean all electrical equipment and materials of all foreign matter (both inside and out). Clean all light fixtures using only methods and materials as recommended by the manufacturer.

PART 20 – PROPOSALS

20.01 The Contractor shall consult the General Conditions and the Proposal Form for proposals and subdivisions of the work required.

PART 21 – EXTENT OF WORK

21.01 The extent of the work under this heading of the contract shall be the furnishing of all plant, labor, materials, and equipment as required to complete work as shown on the drawings and as specified under this heading, and all plant, labor, materials and equipment not shown on the drawings or specified, but necessary to make installation complete in accordance with the intent of the contract, to provide first class, complete, and operative installation throughout.

PART 22 – TAXES

22.01 Contractor shall include all applicable local, state and federal taxes in his bid. Consult the Supplementary Conditions of these specifications relative to any and all tax exemptions permitted for this project.

PART 23 – "AS–BUILT DRAWINGS"

23.01 E.C. shall prepare and submit to the Engineer, upon completion of the project, one complete set of reproducible "As Built" drawings for the electrical portion of the project.

23.02 Drawings shall clearly indicate any and all approved deviations (i.e. addendum items, change order data, etc.) from the Project Bid Documents.

23.03 These drawings will become the property of the Owner and will be for his future reference file, record document.

DIVISION 16 ELECTRICAL

SECTION 16020

BASIC MATERIALS AND METHODS

PART 1 – CONDUIT

1.01 Materials:

A. All conduits and raceways shall be as listed below. No other wiring or raceway systems will be allowed.

B. Rigid conduit (G.R.S.) and intermediate metal conduits (IMC) shall be standard size, hot dip galvanized steel conduit, minimum 1/2" trade size, as manufactured by Triangle PWC, Inc., Allied, or equal. Rigid conduit and IMC shall be provided with threaded fittings and couplings. In trade sizes 2–1/2" to 4", contractor may use Allied KwikCouple' fittings in lieu of individual steel couplings. Where 'Kwik–Couple' fittings are used exterior for vertical risers, install fitting with taper end up. A "green" ground wire, sized per NEC 250–95, shall be installed in all conduits containing phase conductors.

C. E.M.T. (thinwall conduit) shall be minimum 1/2" trade size, as manufactured by Triangle PWC, Inc., Allied, or equal. Provide EMT with Thomas and Betts, or equal. U.L. listed steel or die–cast type fittings. Indenter type fittings shall not be used. Contractor may use Allied 'Kwik–Fit' fittings in lieu of individual fittings. A "green" ground wire, sized per NEC 250–95, shall be installed in all conduits containing phase conductors. E.M.T. (thinwall conduit) shall be minimum 1/2" trade size, as manufactured by Triangle PWC, Inc., Allied, or equal. Provide EMT with Thomas and Betts, or equal. U.L. listed steel or die–cast type fittings. Indenter type fittings shall not be used. Contractor may use Allied 'Kwik–Fit' fittings in lieu of individual fittings. A "green" ground wire, sized per NEC 250–95, shall be installed in all conduits containing phase conductors. E.M.T. conduit shall not be installed in earth or below grade.

D. All conduit installed in wet locations, exposed exterior to the building, or subjected to physical abuse (i.e. industrial locations), shall be rigid steel conduit (G.R.S.) or intermediate metal conduit (I.M.C.). All conduit installed in earth or below grade shall be rigid steel conduit (G.R.S.), intermediate metal conduit (I.M.C.), or U.L. approved schedule 40 P.V.C. conduit.

E. Thin wall conduit (E.M.T.) may be used where code permits except as outlined above.

F. Short runs of galvanized or liquid tight steel flexible conduit may be used where approved by the Engineer (Minimum 1/2" trade size.) A separate "green" ground conductor (sized per N.E.C.) shall be installed in all flexible conduits. Type AC "Armored Cable", Type MC "Metal–clad Cable", or "BX" cable shall not be used in any manor unless supplied as part of a manufactured flexible wiring system for lighting and approved by the Engineer.

G. U.L. approved schedule 40 P.V.C. conduit may only be used where conduits are to be run in earth or below slabs. P.V.C. conduits shall not be used above grade inside or outside of the building, unless specifically noted otherwise on the drawings. Use G.R.S. ells and risers, both horizontal and vertical. Use conduit adapters when converting from P.V.C. to steel conduit. Branch circuit and feeder P.V.C. conduit to be 3/4" min. Concrete encase all conduit installed below grade where so noted on the drawings, (U.L. approved schedule 40 P.V.C. with plastic spacers) All P.V.C. conduit shall be provided with a separate "green" ground conductor, sized per N.E.C.

1.02 Bushings and Locknuts:

A. Where conduits enter boxes, they shall be rigidly clamped to the box by double locknuts and bushings. Conduit shall enter the box squarely. Bushings and locknuts shall be made of malleable iron and shall have sharp clean–cut threads.

1.03 Conduit Installation:

A. Where conduit sizes are not specifically indicated, provide sizes in accordance with the requirements of the N.E.C.

PART 18 – CONTRACT CHANGES

18.01 All changes or deviations from the contract, including those for extra or additional work, must be submitted in writing for the approval of the Architect/Engineer. No verbal orders will be recognized.

PART 19 – RUBBISH/CLEANUP

19.01 All rubbish resulting from the work herein specified shall be periodically removed by this Contractor.

19.02 Clean all electrical equipment and materials of all foreign matter (both inside and out). Clean all light fixtures using only methods and materials as recommended by the manufacturer.

PART 20 – PROPOSALS

20.01 The Contractor shall consult the General Conditions and the Proposal Form for proposals and subdivisions of the work required.

PART 21 – EXTENT OF WORK

21.01 The extent of the work under this heading of the contract shall be the furnishing of all plant, labor, materials, and equipment as required to complete work as shown on the drawings and as specified under this heading, and all plant, labor, materials and equipment not shown on the drawings or specified, but necessary to make installation complete in accordance with the intent of the contract, to provide first class, complete, and operative installation throughout.

PART 22 – TAXES

22.01 Contractor shall include all applicable local, state and federal taxes in his bid. Consult the Supplementary Conditions of these specifications relative to any and all tax exemptions permitted for this project.

PART 23 – "AS–BUILT DRAWINGS"

23.01 E.C. shall prepare and submit to the Engineer, upon completion of the project, one complete set of reproducible "As Built" drawings for the electrical portion of the project.

23.02 Drawings shall clearly indicate any and all approved deviations (i.e. addendum items, change order data, etc.) from the Project Bid Documents.

23.03 These drawings will become the property of the Owner and will be for his future reference file, record document.

DIVISION 16 ELECTRICAL

SECTION 16020

BASIC MATERIALS AND METHODS

PART 1 – CONDUIT

1.01 Materials:

A. All conduits and raceways shall be as listed below. No other wiring or raceway systems will be allowed.

B. Rigid conduit (G.R.S.) and intermediate metal conduits (IMC) shall be standard size, hot dip galvanized steel conduit, minimum 1/2" trade size, as manufactured by Triangle PWC, Inc., Allied, or equal. Rigid conduit and IMC shall be provided with threaded fittings and couplings. In trade sizes 2–1/2" to 4", contractor may use Allied KwikCouple' fittings in lieu of individual steel couplings. Where 'Kwik–Couple' fittings are used exterior for vertical risers, install fitting with taper end up. A "green" ground wire, sized per NEC 250–95, shall be installed in all conduits containing phase conductors.

C. E.M.T. (thinwall conduit) shall be minimum 1/2" trade size, as manufactured by Triangle PWC, Inc., Allied, or equal. Provide EMT with Thomas and Betts, or equal. U.L. listed steel or die–cast type fittings. Indenter type fittings shall not be used. Contractor may use Allied 'Kwik–Fit' fittings in lieu of individual fittings. A "green" ground wire, sized per NEC 250–95, shall be installed in all conduits containing phase conductors. E.M.T. conduit shall not be installed in earth or below grade.

D. All conduit installed in wet locations, exposed exterior to the building, or subjected to physical abuse (i.e. industrial locations), shall be rigid steel conduit (G.R.S.) or intermediate metal conduit (I.M.C.). All conduit installed in earth or below grade shall be rigid steel conduit (G.R.S.), intermediate metal conduit (I.M.C.), or U.L. approved schedule 40 P.V.C. conduit.

E. Thin wall conduit (E.M.T.) may be used where code permits except as outlined above.

F. Short runs of galvanized or liquid tight steel flexible conduit may be used where approved by the Engineer (Minimum 1/2" trade size.) A separate "green" ground conductor (sized per N.E.C.) shall be installed in all flexible conduits. Type AC "Armored Cable", Type MC "Metal–clad Cable", or "BX" cable shall not be used in any manor unless supplied as part of a manufactured flexible wiring system for lighting and approved by the Engineer.

G. U.L. approved schedule 40 P.V.C. conduit may only be used where conduits are to be run in earth or below slabs. P.V.C. conduits shall not be used above grade inside or outside of the building, unless specifically noted otherwise on the drawings. Use G.R.S. ells and risers, both horizontal and vertical. Use conduit adapters when converting from P.V.C. to steel conduit. Branch circuit and feeder P.V.C. conduit to be 3/4" min. Concrete encase all conduit installed below grade where so noted on the drawings, (U.L. approved schedule 40 P.V.C. with plastic spacers) All P.V.C. conduit shall be provided with a separate "green" ground conductor, sized per N.E.C.

1.02 Bushings and Locknuts:

A. Where conduits enter boxes, they shall be rigidly clamped to the box by double locknuts and bushings. Conduit shall enter the box squarely. Bushings and locknuts shall be made of malleable iron and shall have sharp clean–cut threads.

1.03 Conduit Installation:

A. Where conduit sizes are not specifically indicated, provide sizes in accordance with the requirements of the N.E.C.

B. Conduit work in general shall be installed concealed in walls, floor and roof construction or concealed within furred spaces. Exposed work shall include only feeders and short connections to equipment in equipment rooms unless noted otherwise. All exposed conduits (where approved by the Engineer) shall be routed parallel and/or perpendicular to building elements.

C. Conduit to be installed to the requirements of structure and not to the detriment of other work on the project. Conduit shall be installed to clear all openings, depressions, pipes, ducts, reinforcing steel, etc. Conduit set in forms for concrete structure shall be installed in such a manner that installation will not impair the strength of the structure. Coordinate installation with Structural Engineer for conduits rising up from floor slabs into partitions or panelboards. Minimum distance between conduits shall be 6". Maximum size of conduit permitted in concrete slabs, if so approved by the Architect, is 1" trade size.

D. Conduit shall be installed continuous between connections to outlets, boxes and cabinets with a minimum possible number of bends and not more than the equivalent of 4–90 degree bends between j–box connections. Bends shall be smooth and even and shall be made without flattening conduit or flaking enamel. Radius of bends shall be as long as possible and never shorter than the corresponding trade elbow. Long radius elbows shall be used where necessary.

E. Conduits shall be securely fastened in place with approved straps, hangers, and steel supports as required by the National Electrical Code. Any surface mounted conduits on walls below eight foot above grade shall be secured with conduit straps, no clamps. The use of wire, plumbers straps, etc. will not be permitted.

F. Junction and pull boxes shall be installed where shown on drawings and additional boxes shall be installed if required to facilitate pulling of wire, provided location and installation is approved by the Architect. All boxes shall be code gauge construction with screw type covers and shall be installed in accessible locations.

G. Conduit shall be reamed and thoroughly cleaned before installation and kept clean after installation. Openings shall be plugged so that dirt shall be covered as required to keep conduit clean during construction. All conduit shall be fished clear of obstructions before pulling of wire. All conduit shall be as sized above and shall not be smaller than N.E.C. listed minimum requirements.

H. All work shall be protected against damage during construction and any work damaged or moved out of line after construction shall be repaired and put back to the approval of the Architect without additional cost to the Owner.

I. Conduit terminations at panelboards, switchboards, motor control centers, junction boxes, etc., shall be aligned and installed true and plumb. Wood or steel backs or templates shall be used where required. Wall mounted cabinets, etc., steel supports as required for mounting of returned equipment excepting only where steel supports are specified to be furnished under another specification heading.

J. Where conduits cross construction expansion joints, Contractor shall provide Appleton XJ or equal expansion couplings with copper bonding jumpers.

K. Where conduits are installed in concrete, all connections and couplings shall be water tight or rated for direct build in concrete.

L. Mechanical equipment service clearances and electrical apparatus service clearance as specified in their respective manufacturer's product data shall be maintained free from conduit and raceways.

M. All conduits routed below grade shall be minimum 30" below grade unless noted otherwise on the drawings. All conduits routed below floor slabs shall be installed a minimum of 4" below the slab.

PART 2 – WIRES AND WIRING

2.01 American, Southwire, Essex, or equal code gauge wire, rated 600V, finished with fadeless color coding and bearing Underwriter's label. Wires shall be soft annealed copper with properties conforming to the National Electrical Code requirements. No. 8 gauge and larger shall be stranded. Minimum size for power supplies may be solid or stranded, unless noted otherwise on the drawings. Stranded conductors shall only be used on devices and lugs that are U.L. listed for use with stranded conductors.

2.02 Wire smaller than No. 12 gauge shall not be used unless specifically noted so on the drawings.

2.03 Unless noted otherwise on the Electrical drawings or herein, all wiring for all systems shall be routed within conduit, shall be of the same insulation type and shall be continuous between outlets and boxes (with no splices or taps into conduit). Splices and taps in outlet boxes shall be twisted joints. U.L. approved pre–insulated spring pressure connectors shall be used for branch circuit connections. Connectors shall be installed so that all conductors are properly insulated.

2.04 All control wiring shall be copper, solid or stranded, #14 Ga. or larger depending upon current requirements, with insulation type for 90 C. rating. Where stranded conductors are used, provide with spade type insulated copper terminals. Unless noted otherwise on the Mechanical drawings or herein, all mechanical control wiring for all systems shall be routed within conduit, shall be of the same insulation type and shall be continuous between outlets and boxes (with no splices or taps into conduit).

2.05 See riser diagrams and/or other sections of the Specifications for types and ratings for sound, fire alarm, control and other special cables.

2.06 Wires for general use within the building shall be type THHN or type THWN, 90 degree rated except where called for otherwise on the drawings. Type THWN or type THHN shall be used at the temperature rating of equipment termination lugs, environmental conditions, and as Code allows. Wires for other than general use shall be as hereinafter specified for specific services.

2.07 A "green" insulated ground conductor, sized per N.E.C. 250–95 and/or as shown on the drawings, shall be installed in each conduit containing phase conductors.

2.08 Where quantities of conductors in a raceway system are not specifically indicated, provide the number as required to maintain function, control and number of circuits as indicated.

2.09 All conductors shall be identified at all termination points and in all pull and junction boxes by the following method of color coding:

208Y/120 Volt System			240/120 Volt System	
480Y/277 Volt System				
Phase A	Black	Phase A	Black	Phase A Brown
Phase B	Red	Phase B	Red	Phase B Orange
Phase C	Blue	Phase C	Blue	Phase C Yellow
Neutral	White	Neutral	White	Neutral Gray
Ground	Green	Ground	Green	Ground Green

*(Note: identify "high leg" per N.E.C.)

2.10 All conductors size #6 AWG and smaller shall have colored insulation. Where conductors with black insulation are used for the larger wire sizes (#4