INDEX

DIVISION 26 - ELECTRICAL

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SECTION 260500 - GENERAL PROVISIONS - ELECTRICAL

PART 1 – GENERAL:

1.1 The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

1.2 Each Contractor shall be governed by any alternates, unit prices and Addenda or other contract documents insofar as they may affect his part of the work.

1.3 The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating Electrical Systems indicated on the drawings and/or specified herein.

1.4 Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Electrical Systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

1.5 It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime contract, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the Contractor to the Architect (if applicable), then to the Engineer.

1.6 This section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

1.7 It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials to be installed by other trades without additional cost to the Owner.

1.8 In general, and to the extent possible, all work shall be accomplished without interruption of the existing facilities' operations. Each Contractor shall advise the Architect, Owner and Engineer in writing at least one week prior to the deliberate interruption of any services. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will occur. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.

1.9 Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable

utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

1.10 Definitions:

1.10.1 Prime Contractor - The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.

1.10.2 Electrical Contractor - Any Contractor whether bidding or working independently or under the supervision of a General Contractor, that is: the one holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, television, telecommunications, data, fiber optic, intercom, fire detection and alarm, security, video, underground or overhead electrical, etc.

1.10.3 Electrical Sub-Contractor - Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.

1.10.4 Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owner, Architect, other Engineers, etc.

1.10.5 Architect - The Architect of Record for the project, if any.

1.10.6 Furnish - Deliver to the site in good condition.

1.10.7 Provide - Furnish and install in complete working order.

1.10.8 Install - Install equipment furnished by others in complete working order.

1.10.9 Contract Documents - All documents pertinent to the quality and quantity of all work to be performed on the project. Includes, but not limited to: Plans, Specifications, Addenda, Instructions to Bidders, (both General and Sub-Contractors), Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Construction Manager's Assignments, Architect's Supplemental Instructions, Periodical Payment Requests, etc.

1.10.10 Note: Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an attempt to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor or Construction Manager holding the prime contract, unless otherwise provided herein.

PART 2 – INTENT:

2.1 It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use.

2.2 Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

PART 3 - ELECTRICAL DRAWINGS AND SPECIFICATIONS:

3.1 The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for review before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.

3.2 The drawings and specifications are intended to supplement each other. No Contractor or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.

3.3 The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

3.4 This Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.

3.5 The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance.

3.6 Each Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.

3.7 Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.

3.8 The Electrical drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether given in figures or scaled shall be verified in the field. In case of conflict between small and large scale drawings, the larger scale drawings shall take precedence.

3.9 The Electrical Contractor and his Sub Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten days prior to bids, for issuance of clarification by written addendum.

3.10 Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

3.11 Special Note: Always check ceiling heights indicated on Drawings and Schedules and insure that these heights may be maintained after all mechanical and electrical equipment is installed. If a conflict is apparent, notify the Engineer in writing for instructions.

PART 4 - EXAMINATION OF SITE AND CONDITIONS:

4.1 Each Contractor shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and

location of necessary facilities and all relevant matters concerning the work. All Contractors shall carefully examine all Drawings and Specifications and inform themselves of the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of his work.

4.2 Each Contractor shall fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in his work all expenses or disbursements in connection with such matters and conditions. Each Contractor shall verify all work shown on the drawings and conditions at the site, and shall report in writing to the Engineer ten days prior to bid, any apparent omissions or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

PART 5 - EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS:

5.1 When any Contractor requests review of substitute materials and/or equipment, and when under an approved formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without additional cost regardless of changes in connections, spacing, service, mounting, etc. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Special Note: Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility.

5.2 References in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Each Contractor, in such cases, may, at his option, use any article, device, product, material, fixture, form, or type of construction which in the judgement of the Engineer is equivalent to that specified, provided the provisions of paragraph (5.1) immediately preceding are met. Substitutions shall be submitted to the Engineer a minimum of ten days prior to bid date for approval to bid in written form thru addenda or other method selected by the Engineer. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

5.3 Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the engineers.

5.4 Each Contractor shall furnish along with his proposal a list of specified equipment and materials which he proposes to provide. Where several makes are mentioned in the Specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall have the right to choose any of the makes mentioned without change in price.

PART 6 - SUPERVISION OF WORK:

6.1 Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act for him in matters related to the project.

PART 7 - CODES, RULES, PERMITS, FEES, REGULATIONS, ETC.:

7.1 The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, and other costs including utility connections or extensions, in connection with his work. As necessary, he shall file all required plans, utility easement requests and drawings, survey information on line locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and

governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work..

7.2 Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.

7.3 The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus or drawings required in order to comply with all applicable laws, ordinances rules and regulations, whether or not shown on drawings and/or specified.

7.4 All materials furnished and all work installed shall comply with the current edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.

7.5 All material and equipment for the electrical systems shall bear the approval label, or shall be listed by the Underwriters' Laboratories, Incorporated. Listings by other testing agencies may be acceptable with written approval by the Engineer.

7.6 All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Fire Marshal, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.

7.7 The Contractor shall insure that his work is accomplished in accord with OSHA Standards and any other applicable government requirements.

7.8 Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

PART 8 - COST BREAKDOWNS:

8.1 Within thirty days after acceptance of the Contract, each Contractor is required to furnish to the Engineer one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made on forms provided or approved by the Engineer or Architect. Payments will not be made until satisfactory cost breakdowns are submitted.

PART 9 - GUARANTEES AND WARRANTIES:

9.1 **(FOR ALL KDE PROJECTS):** The Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to the best of its respective kind and shall replace all parts at his own expense, which are proven defective within the time frame outlined in the General Conditions of the Contract. The effective date of completion of the work shall be the date of the Engineer's Statement of Substantial Completion.

9.2 Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of

final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

OR

(FOR ALL PRJECTS EXCEPT KDE): The Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to the best of its respective kind and shall replace all parts at his own expense, which are proven defective within one year from final acceptance of the work by the Engineer. The effective date of completion of the work shall be the date of the Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

PART 10 - INSPECTION, APPROVALS AND TESTS:

10.1 *Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect his installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.

10.2 *Electrical inspection will be performed throughout the course of construction by a certified electrical inspector from the Department of Housing, Buildings and Construction. When the project is complete and in compliance with applicable codes, rules and regulations, the inspector shall issue a certificate of compliance to the Owner.

10.3 *The Contractor shall provide as a part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services in the Commonwealth of Kentucky. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.

(*) **PLEASE CHOOSE THE ONE APPROPRIATE FOR YOUR PROJECT.**

10.4 The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when he anticipates commencing work. Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.

10.5 Inspections shall be scheduled for rough as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.

10.6 Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.

10.7 Before final acceptance, the Contractor shall furnish three copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

10.8 The Contractor shall test all wiring and connections for continuity and grounds before equipment and fixtures are connected, and when indicated or required, demonstrate by Megger Test the insulation resistance of any circuit or group of circuits. Where such tests indicate the possibility of faulty insulation, locate the point of such fault, pull out the defective conductor, replacing same with new and demonstrate by further test the elimination of such defect.

PART 11 - CHANGES IN ELECTRICAL WORK:

11.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 12 - CLAIMS FOR EXTRA COST:

12.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 13 - SURVEYS, MEASUREMENTS AND GRADES:

13.1 The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.

13.2 The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.

13.3 Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer thru normal channels of job communication and shall not proceed with his work until he has received instructions from the Engineer.

PART 14 - TEMPORARY USE OF EQUIPMENT:

14.1 The permanent electrical equipment, when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without cost, leaving the equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.

14.2 Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

PART 15 - TEMPORARY SERVICES:

15.1 The Contractor shall arrange for temporary electrical and other services which he may require to accomplish his work. In the absence of other provisions in the contract, the Contractor shall provide for his own temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in his bid.

PART 16 - RECORD DRAWINGS:

16.1 The Contractor shall insure that any deviations from the design are being recorded daily or as necessary on record drawings being maintained by the Contractor. Dimensions from fixed, visible permanent lines or landmarks shown in vertical and horizontal ways shall be utilized. Compliance shall be a requirement for final payment. Pay particular attention to the location of underfloor or underground exterior in-contract or utility-owned or leased service lines, main switches and other appurtenances important to the maintenance and safety of the Electrical System. Deliver these record drawings to the Engineer at the completion of the work.

PART 17 - MATERIALS AND WORKMANSHIP:

17.1 All electrical equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).

17.2 All conduit and/or conductors shall be concealed in or below walls, floors or above ceilings unless otherwise noted. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein.

17.3 All materials, where applicable, shall bear Underwriters' Laboratories label or that of another Engineer-approved testing agency, where such a standard has been established.

17.4 Each length of conduit, wireway, duct, conductor, cable, fitting, fixture and device used in the electrical systems shall be stamped or indelibly marked with the makers mark or name.

17.5 All electrical equipment shall bear the manufacturer's name and address and shall indicate its electrical capacity and characteristics.

17.6 All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.

PART 18 - QUALIFICATIONS OF WORKMEN:

18.1 All electrical contractors bidding this project must have been a licensed company for a minimum of three years to qualify to bid this project. Individual employee experience does not supercede this requirement.

18.2 All subcontractors bidding the electrical work must have completed one project of 70% this subcontract cost size and two projects of 50% this subcontract cost size.

18.3 All electrical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workmen shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.

18.4 All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

18.5 Special electrical systems, such as Fire Detection and Alarm Systems, Intercom or Sound Reinforcement Systems, Telecommunications or Data Systems, Lightning Protection Systems, Video Systems, Special Electronic Systems, Control Systems, etc., shall be installed by workmen normally engaged or employed in these respective trades. As an exception to this, where small amounts of such work are required and are, in the opinion of the Engineer, within the competency of workmen directly employed by the Contractor involved, they may be provided by this Contractor.

PART 19 - CONDUCT OF WORKMEN:

19.1 The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden.

PART 20 - COOPERATION AND COORDINATION BETWEEN TRADES:

20.1 The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Mechanical, Structural and other pertinent Drawings, to the end that complete coordination between trades will be effected.

20.2 Refer to Coordination Among Trades, Systems Interfacing and Connection of Equipment Furnished by Others section of these Specifications for further coordination requirements.

PART 21 - PROTECTION OF EQUIPMENT:

21.1 The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All rough-in conduit shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor.

PART 22 - CONCRETE WORK:

22.1 The Contractor shall be responsible for the provision of all concrete work required for the installation of any of his systems or equipment. If this work is provided by another trade, it will not relieve the Electrical Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Electrical work shall be 3000 PSI minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication ACI-318. Heavy equipment shall not be set on pads for at least seven days after pour.

22.2 All concrete pads shall be complete with all pipe sleeves, embeds, anchor bolts, reinforcing steel, concrete, etc., as required. Pads larger than l8" in width shall be reinforced with minimum #4 round bars on 6" centers both ways. All reinforcing steel shall be per ASTM requirements, tied properly, lapped 18 bar diameters and supported appropriately up off form, slab or underlayment. Bars shall be approximately 3" above the bottom of the pad with a minimum 2" cover. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms properly adhered repairs shall be made. If structural integrity is violated, the concrete shall be replaced. All surfaces shall be rubbed to a smooth finish.

22.3 Special Note: All pads and concrete lighting standard bases shall be crowned slightly so as to avoid water ponding beneath equipment.

22.4 In general, concrete pads for small equipment shall extend 6" beyond the equipment's base dimensions. For large equipment with service access panels, extend pads l8" beyond base or overall dimensions to allow walking and servicing space at locations requiring service access.

22.5 Exterior concrete pads shall be 4" minimum above grade and 4" below grade on a tamped 4" dense grade rock base unless otherwise noted or required by utility company. Surfaces of all foundations and bases shall have a smooth finish with three-quarter inch radius or chamfer on exposed edges, trowelled or rubbed smooth. All exterior pads shall be crowned approximately 1/8" per foot, sloping from center for drainage.

PART 23 - RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, ETC.:

23.1 The Contractor shall restore to their original condition all paving, curbing surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item to be replaced. All repairs shall be to the satisfaction of the Engineer, and in accord with the Architect's standards for such work, as applicable.

PART 24 - MAINTENANCE OF EXISTING UTILITIES AND LINES:

24.1 The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that come within the contract construction site, shall be subject to continuous uninterrupted maintenance with no exception unless the Owner of the utilities grants permission to interrupt same temporarily, if need be. Provide one week's written notice to Engineer, Architect and Owner prior to interrupting any utility service or line. Also see Article 1. - General, this section.

24.2 Known utilities and lines as available to the Engineer are shown on the drawings. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain that no utilities or lines, known or unknown, are endangered by the excavation.

24.3 If the above mentioned utilities or lines occur in the earth within the construction site, the Contractor shall first probe and make every effort to locate the lines prior to excavating in the respective area.

24.4 Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.

24.5 The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

24.6 Machine excavation shall not be permitted within ten feet of existing gas or fuel lines. Hand excavate only in these areas, in accord with utility company, agency or other applicable laws, standards or regulations.

24.7 Protect all new or existing lines from damage by traffic, etc. during construction.

24.8 Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

PART 25 - SMOKE AND FIRE PROOFING:

25.1 The Contractor shall not penetrate rated fire walls, ceilings or floors with conduit, cable, bus duct, wireway or other raceway system unless all penetrations are protected in a code compliant manner which maintains the rating of the assembly. Smoke and fire stop all openings made in walls, chases, ceiling and floors. Patch all openings around conduit, wireway, bus duct, etc., with appropriate type material to smoke stop walls and provide needed fire rating at fire walls, ceilings and floors. Smoke and fire proofing materials and method of application shall be approved by the local authority having jurisdiction.

PART 26 - QUIET OPERATION, SUPPORTS, VIBRATION AND OSCILLATION:

26.1 All work shall operate under all conditions of load without any objectionable sound or vibration, the performance of which shall be determined by the Engineer. Noise from moving machinery or vibration noticeable outside of room in which it is installed, or annoyingly noticeable noise or vibration inside such room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor (or Contractors responsible) at his expense.

26.2 All equipment subject to vibration and/or oscillation shall be mounted on vibration supports suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc., by means of flexible connectors, vibration absorbers or other approved means. Surface mounted equipment such as panels, switches, etc., shall be affixed tightly to their mounting surface.

26.3 The Contractor shall provide supports for all equipment furnished by him using an approved vibration isolating type as needed. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. No work shall depend on the supports or work of unrelated trades unless specifically authorized in writing by the Architect or Engineer.

PART 27 - FINAL CONNECTIONS TO EQUIPMENT:

27.1 The roughing-in and final connections to all electrically operated equipment furnished under this and all other sections of the contract documents or by others, shall be included in the Contract and shall consist of furnishing all labor and materials for connection. The Contractor shall carefully coordinate with equipment suppliers, manufacturer’s representatives, the vendor or other trades to provide complete electrical and dimensional interface to all such equipment (kitchen, hoods, mechanical equipment, panels, refrigeration equipment, etc.).

PART 28 – WELDING:

28.1 The Contractor shall be responsible for quality of welding done by his organization and shall repair or replace any work not done in accordance with the Architect's or structural Engineer's specifications for such work. If required by the Engineer, the responsible Contractor shall cut at least three welds during the job for X-raying and testing. These welds are to be selected at random and shall be tested as a part of the responsible Contractor's work. Certification of these tests and X-rays shall be submitted, in triplicate, to the Engineer. In case a faulty weld is discovered, the Contractor shall be required to furnish additional tests and corrective measures until satisfactory results are obtained.

PART 29 – ACCESSIBILITY:

29.1 The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of his work. He shall cooperate with the General Contractor (or Construction Manager) and all other Contractors whose work is in the same space, and shall advise each Contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.

29.2 The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.

29.3 Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be installed in accord with the Architect's standards for such work.

29.4 Access Doors; in Ceilings or Walls:

29.4.1 In mechanical, electrical, or service spaces:

29.4.1.1 14 gauge aluminum brushed satin finish, 1" border.

29.4.2 In finished areas:

29.4.2.1 14 gauge primed steel with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.

29.4.3 In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

PART 30 - ELECTRICAL CONNECTIONS:

30.1 The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. The Contractor shall install all starters not factory mounted on equipment. Unless otherwise noted, the supplier of equipment shall furnish starters with the equipment. Also refer to Mechanical Sections of Specifications, shop drawings and equipment schedules for additional information.

30.2 All control, interlock, sensor, thermocouple and other wiring required for equipment operation shall be provided by the Contractor. All such installations shall be fully compliant with all requirements of Electrical Specifications regardless of which trade actually installs such wiring. Motors and equipment shall be provided for current and voltage characteristics as indicated or required. All wiring shall be enclosed in raceways unless otherwise noted.

30.3 Each Contractor or sub-contractor, prior to bidding the work, shall coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other contractors or sub-contractors, to ensure all needed wiring is provided in the Contract. Failure to make such coordination shall not be justification for claims of extra cost or a time extension to the Contract.

PART 31 – MOTORS:

31.1 Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box and N.E.C. required disconnecting means as indicated or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.

31.2 The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower as applicable. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Mechanical Sections of Specifications for further requirements and scheduled sizes.

PART 32 - CUTTING AND PATCHING:

32.1 Unless otherwise indicated or specified, the Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accord with the Architect's standards for such work, as applicable.

32.2 No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.

PART 33 - SLEEVES AND PLATES:

33.1 Each Contractor shall provide and locate all sleeves and inserts required for his work before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

33.2 Sleeves shall be provided for all electrical conduit passing thru concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves shall not be provided for piping running embedded in concrete or insulating concrete slabs on grade, unless otherwise noted.

33.3 Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be packed with oakum and lead, mechanical waterstop or other approved material and made completely water tight by a method approved by the Engineer and/or Architect.

33.4 Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:

33.4.1 Terminate sleeves flush with walls, partitions and ceiling.

33.4.2 In areas where pipes are concealed, as in chases, terminate sleeves flush with floor.

33.4.3 In all areas where pipes are exposed, extend sleeves ¼ inch above finished floor, except in rooms having floor drains, where sleeves shall be extended 3/4 inches above floor.

33.5 Sleeves shall be constructed of 24 gauge galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated on the drawings.

33.6 Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction occurs around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction. Fire and smoke stop all sleeves in a manner approved by the local authority having jurisdiction or per prevailing codes.

PART 34 – WEATHERPROOFING:

34.1 Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

34.2 Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

PART 35 - OPERATING INSTRUCTIONS:

35.1 Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating his systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or his representative fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.

35.2 Each Contractor shall furnish three complete bound sets for approval to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.

35.3 Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

PART 36 - SCAFFOLDING, RIGGING AND HOISTING:

36.1 The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

PART 37 – CLEANING:

37.1 The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish caused by his operations; and at the completion of the work, shall remove all rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible or all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.

37.2 After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

PART 38 – PAINTING:

38.1 Each fixture device, panel, junction box, etc., that is located in a finished area shall be provided with finish of color and type as selected or approved by the Architect or Engineer. If custom color is required, it shall be provided at no additional cost to the Owner. All other equipment, fixtures or devices located in finished or unfinished areas, that are not required to have or are provided with finish color or coating shall be provided in a prime painted condition, ready to receive finish paint or coating. All galvanized metal in finished areas shall be properly prepared with special processes to receive finish paint as directed and approved by the Architect.

PART 39 – INDEMNIFICATION:

39.1 The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 40 - HAZARDOUS MATERIALS:

40.1 The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

40.2 CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

40.3 If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.

40.4 The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

PART 41 - ABOVE-CEILING AND FINAL PUNCH LISTS:

41.1 The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project:

41.1.1 For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.

41.1.2 For review of all other work as the project nears substantial completion.

41.2 When all work from the Contractor's punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.

41.3 If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of $75.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.

PART 42 - DISPOSAL OF LAMPS (JCPS Projects):

42.1 The Contractor shall be responsible for the careful removal of all lamps and fluorescent tubes without breakage from existing fixtures.

42.2 Lamps removed from fluorescent, metal halide, mercury and sodium fixtures that do not have green end caps shall be placed by the Contractor in cardboard boxes furnished by JCPS for recycling. The contractor shall label each box with the type and quantity of lamps in each box and seal the box. Boxes shall be stored at the project site in an area safe from breakage, vandalism and fire.

42.3 Broken fluorescent, metal halide, mercury and sodium lamps without green end caps shall be immediately and carefully cleaned up by the Contractor and placed in a 55 gallon steel drum furnished by JCPS. The contractor shall reimburse JCPS for the cost to dispose of these broken lamps, which is approximately $250.00 per drum.

42.4 Incandescent lamps and lamps and tubes with green end caps shall be legally disposed of by the Contractor.

42.5 Green end cap lamps and broken lamps shall not be placed in any box designated for recycling lamps.

42.6 When all lamps have been removed and properly stored, the Contractor shall notify JCPS that the lamps to be recycled are ready for pick-up by the JCPS Universal Waste Recycling Transporter. JCPS pays the cost to recycle these lamps.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260501 - DESCRIPTION OF ELECTRICAL SYSTEM

PART 1 - ELECTRICAL PRIMARY SERVICE:

1.1 Primary electrical service shall be underground, 12,470 volts, three phase, wye, to a pad-mount transformer as indicated on the plans.

1.2 Provide primary conduit, riser, concrete transformer pad, pull ropes, C/T installation and trenching in accord with Utility Company requirements.

1.3 In general, the utility company will provide the pad-mounted transformer, primary cable and its terminations. Riser conduit on utility pole and all other work shall be in accord with utility company requirements. Contact the utility company prior to bidding the work and include any and all charges for their work in bid.

PART 2 - SECONDARY SERVICE:

2.1 Secondary service shall be 277/480V/3Ø/4W with solid grounded neutral. See Electrical Riser Diagram. Trench, backfill, conduit, lugs, conductors, meterbase and CT cabinet (if required) by Electrical Contractor.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260502 - SCOPE OF THE ELECTRICAL WORK

PART 1 – GENERAL:

1.1 Each Electrical Contractor's attention is directed to Section 260500 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

PART 2 - SCOPE OF THE ELECTRICAL WORK:

2.1 The Electrical work for this project includes all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner complete electrical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not limited to the following:

2.2 All conduits, conductors, outlet boxes, fittings, etc.

2.3 All panels, disconnect switches, fuses, transformers, contactors, starters, etc.

2.4 All wiring devices and device plates.

2.5 All light fixtures and lamps.

2.6 Electrical connection to all electrically operated equipment furnished and/or installed by others, including kitchen equipment.

2.7 Telephone conduit system and cabinet.

2.8 Inspection of electrical system by licensed Electrical Inspector.

2.9 Grounding.

2.10 All necessary coordination with electric utility company, telephone company, etc., to insure that work connections, etc., that they are to provide is accomplished.

2.11 Paying all necessary fees and cost for permits, inspections, work by utility companies, etc. The Contractor shall contact the utility companies prior to submitting a bid to determine exactly what these charges will be.

2.12 Prior to submitting a bid, the Contractor shall contact all serving utility companies to determine exactly what each utility company will provide and exactly what is required of the Contractor and shall include such requirements in his base bid.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260503 - SHOP DRAWINGS, LITERATURE, MANUALS, PARTS LISTS, AND SPECIAL TOOLS

PART 1 - SHOP DRAWINGS:

1.1 Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, seven sets of shop drawings and/or manufacturer's descriptive literature on all equipment required for the fulfillment of his contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced so the specifications, schedules, light fixture numbers, panel names and numbers, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.

1.2 If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.

1.3 Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

1.4 The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.

1.5 No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.

1.6 In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:

1.7 Power Equipment:

1.7.1 Switchgear and panelboards.

1.7.2 Circuit breakers or fusible switches, per each type.

1.7.3 Dry type transformers.

1.7.4 Liquid-filled pad mount transformers and their accessories.

1.7.5 Power and lighting contactors.

1.7.6 Disconnect switches.

1.7.7 Fuses, per each type required.

1.7.8 Magnetic starters, if not submitted with unit equipment by supplier.

1.7.9 Control components (relays, timers, selector switches, pilots, etc.)

1.7.10 Primary cable (over 600 volts) and each style of termination fitting for primary cable.

1.7.11 Building service grounding electrode components.

1.7.12 Metering devices.

1.7.13 Bus duct and each type of fitting for bus duct.

1.7.14 Emergency generator, engine fuel system and transfer switch, with all required generator system accessories, such as battery charger, batteries, exhaust system and its insulation, fuel pumps, day tanks, etc.

1.8 Raceways:

1.8.1 Cable tray and each type of cable tray fitting.

1.8.2 Wireways and each type of wireway fitting.

1.8.3 Surface-mounted metal or plastic raceways, with each type of fitting.

1.9 Devices:

1.9.1 Each type of wiring device and their coverplates.

1.9.2 Floor boxes, each by type, with required accessories.

1.9.3 Data/voice/video wallplates, each type.

1.9.4 Any special items not listed above.

1.10 Lighting

1.10.1 Light fixtures, each by type, marked to indicate all required accessories and lamp selection. Also provide original color selection chart to allow Architect and/or Engineer to indicate color selection.

1.10.2 Lamps, each by type.

1.10.3 Lighting standards or poles.

1.10.4 Flexible modular wiring system with cutsheets and layout drawings.

1.10.5 Photocells, time clocks or other lighting accessories.

1.11 Systems

1.11.1 Note: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Also provide scale building layout drawings that indicate device placement, wiring, etc. Refer to specific system's specification for additional submittal requirements where required.

1.11.2 Fire alarm system

1.11.3 Security system

1.11.4 Building paging/intercom audio system

1.11.5 Clock/Program system

1.11.6 Telephone system

1.11.7 Video system

1.11.8 Data network

1.11.9 Sound reinforcement system (s)

1.11.10 Wireless intercom system

1.11.11 Miscellaneous

1.11.12 Control panel assemblies.

1.11.13 Non-standard junction/pullboxes.

1.11.14 Manholes, hand holes, and all outdoor electrical equipment and fittings.

PART 2 - SPECIAL WRENCHES, TOOLS AND KEYS:

2.1 Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, emergency generators, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

PART 3 - FIRE ALARM SHOP DRAWINGS:

3.1 The contractor and equipment supplier shall submit to the Architect and/or Engineer, fire alarm system shop drawings complete with catalog cuts, descriptive literature and complete system wiring diagrams for their review prior to submittal to the Commonwealth's Department of Housing, Buildings and Construction or other governing authority for their review.

PART 4 - MAINTENANCE AND OPERATION MANUALS:

4.1 Upon substantial completion of the project, the Electrical Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three complete copies of operation and maintenance instructions and parts lists for all equipment provided. These documents shall at least include:

4.2 Detailed operating instructions.

4.3 Detailed maintenance instructions including preventive maintenance schedules.

4.4 Addresses and phone numbers indicating where parts may be purchased.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260504 - CUTTING, PATCHING AND REPAIRING

PART 1 – GENERAL:

1.1 The Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the General Contractor and all other trades. He shall determine and coordinate any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the responsible Contractor.

1.2 The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, buss duct, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Architect. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.

1.3 The Contractor shall cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.

1.4 The Contractor shall notify other trades in due time where he will require openings of chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.

1.5 Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

1.6 Cast iron sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking with lead and oakum between pipe and sleeve for waterproofing.

1.7 In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter.

1.8 Sleeves passing through roof or exterior wall or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed.

1.9 All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.

1.10 No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Architect.

1.11 The Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Architect.

1.12 All work improperly done or not done at all as required by the Electrical trades in this section will be performed by others. The cost of this work shall be paid for by the Contractor who is in non-compliance with the Contract.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260508 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

PART 1 – COORDINATION:

1.1 The Contractor is expressly directed to read the General Conditions and all sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Plumbing Fire Protection, Mechanical and Structural drawings, to the end that complete coordination between trades will be affected. Each Contractor shall make known to all other contractors the intended positioning of materials, raceways, supports, equipment and the intended order of his work. Coordinate all work with other trades and proceed with the installation in a manner that will not create delays for other trades or affect the Owner's operations.

1.2 Special attention to coordination shall be given to points where raceways, fixtures, etc., must cross other ducts or conduit, where lighting fixtures must be recessed in ceilings, and where fixtures, conduit and devices must recess into walls, soffits, columns, etc. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.

1.3 The Contractor shall be responsible for coordination with all trades to insure that they have made provision for connections, operational switches, disconnect switches, fused disconnects, etc., for electrically operated equipment provided under this or any other division of the specifications, or as called for on the drawings. Any connection, circuiting, disconnects, fuses, etc., that are required for equipment operation shall be provided as a part of this contract.

1.4 If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other trade's work, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of fixtures, devices, conduit, and equipment not installed or connected in accordance with the above instructions.

1.5 In all areas where air diffusers, devices, lighting fixtures and other ceiling-mounted devices are to be installed, the Mechanical Trade(s) and the Electrical Trade and the General Trades shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangement that is acceptable to the Architect and Engineer. Where applicable, refer to reflected ceiling plans. Request layouts from the Architect or Engineer where in doubt about the potential acceptability of an installation.

PART 2 – INTERFACING:

2.1 Each Electrical Trade, Specialty Controls Trade, Mechanical Trade and the General Trades, etc., shall insure that coordination is effected relative to interfacing of all systems. Some typical interface points are (but not necessarily all):

2.1.1 Connection of Telecommunications (voice, video, data) lines to Owner's existing or new services.

2.1.2 Connection of Power lines to Owner's existing or new services.

2.1.3 Connection of fuel oil and exhaust piping to emergency generator and furnishing of fuel for testing unit. Provide a full tank at final acceptance.

2.1.4 Connection of all controls to equipment.

2.1.5 Electrical power connections to electrically operated (or controlled) equipment.

2.1.6 Electrical provisions for all equipment provided by other trades or suppliers within this contract.

PART 3 - CONNECTION OF EQUIPMENT FURNISHED BY OTHERS:

3.1 Each Contractor shall make all connections to equipment furnished by others, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.

3.2 All drawings are complementary, one trade of the other. It is the Contractor's responsibility to examine all drawings and specifications to determine the full scope of his work. The project Engineers have arranged the specifications and drawings in their given order solely as a convenience in organizing the project, and in no way shall they imply the assignment of work to specific trades, contractors, subcontractors or suppliers.

3.3 Supervision to assure proper installation, functioning and operation shall be provided by the Contractor furnishing the equipment or apparatus to be connected.

3.4 Items indicated on the drawings as rough-in only (RIO) will be connected by the equipment supplier or Owner, as indicated. The Contractor shall be responsible for rough-in provisions only as indicated. These rough-ins shall be in accord with the manufacturer's or supplier's requirements.

3.5 For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.

3.6 The Contractor shall be responsible for coordinating with the General and all other trades, as necessary, to determine any and all final connections that he is to make to equipment furnished by others.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260515 – SPORTS LIGHTING SYSTEM

PART 1 – GENERAL:

1.1 RELATED DOCUMENTS

1.1.1 Furnish and install a complete, fully operational field lighting system. The system shall be installed complete and ready to operate as per attached specifications.

1.1.2 The Contractor shall furnish and install all equipment, wiring and material required for the installation of the specified system. Any and all material and equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of these specifications and drawings.

1.2 LIGHTING

1.2.1 Lighting Performance

1.2.1.1 The manufacturer shall supply lighting equipment to meet or exceed the following performance criteria:

1.2.2 Field Lighting

1.2.2.1 Performance Criteria

Performance Requirements: Playing surfaces shall be lit to an average constant light level and uniformity as specified in the chart below. Light levels shall be held constant for 25 years. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Measured average illumination level shall be +/- 10% of predicted mean in accordance with IESNA RP-6-01, and measured at the first 100 hours of operation.

Area of Lighting	Target Maintained Average Light Levels	Uniformity Ratio (Maximum to Minimum)	Grid Points	Grid Spacing
Softball Infield	30 footcandles	2.5: 1.0	16	30’ x 30’
Softball Outfield	20 footcandles	3.0: 1.0	65	30’ x 30’
Soccer Field	30 footcandles	2.5: 1.0	66	30’ x 30’
Football Field	30 footcandles	2.5: 1.0	40	30’ x 30’
Entire Area	28 footcandles	15.0: 1.0	383	20’ x 20’

If a constant light level cannot be provided, a maximum Recoverable Light Loss Factor of 0.70 shall be applied to the initial light level design to achieve the following initial and maintained light levels:

Area of Lighting	Initial Average Light Levels	Target Maintained Average Light Levels	Uniformity Ratio (Maximum to Minimum)	Grid Points	Grid Spacing
Softball Infield	42.9 footcandles	30 footcandles	2.5: 1.0	16	30’ x 30’
Softball Outfield	28.8 footcandles	20 footcandles	3.0: 1.0	65	30’ x 30’
Soccer Field	42.9 footcandles	30 footcandles	2.5: 1.0	66	30’ x 30’
Football Field	42.9 footcandles	30 footcandles	2.5: 1.0	40	30’ x 30’
Entire Area	40.0 footcandles	28 footcandles	15.0: 1.0	383	20’ x 20’

For alternate systems, lighting calculations for both initial and maintained light levels shall be submitted. If lighting system does not provide a series of timed power adjustments the above initial light levels must be met. Revised Electrical Distribution: Manufacturer shall provide revised electrical distribution plans to include changes to service entrance, panel, and wire sizing. Any required changes shall be included in bid.

Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, the pole mounting heights from the playing field surface shall be

60’ for pole P1, P2, P4

70’ for pole P3, P5, P6, P7

Refer to the civil drawings for pole location elevations relative to the playing surface.

1.2.2.1.1 Manufacturer shall submit computer-generated light scan showing the following:

1.2.2.2 Point-by-point horizontal foot-candles

1.2.3 Lighting controls

1.2.3.1 The light poles are to be controlled in 3 different zones for each field activity

Switching Schedule		
Field Type	Zones	Zone Description
Soccer/Softball	1,2	Softball
Soccer	1,2	Soccer
Football	2,3	Football

1.2.3.2

Zone Schedule				
			Circuit Descriptions	
Zone	Selector Switch	Zone Description	Pole ID	Contactor ID
Zone 1	1	Soccer/Baseball	P4 P5 P6	C1 C2 C3
Zone 2	2	Softball/Baseball/Football	P3 P7	C4 C5
Zone 3	3	Football	P1 P2	C6 C7

1.3 ENVIRONMENTAL LIGHT CONTROL

1.3.1.1 Spill Light Control: Light levels shall not exceed the designated maximum footcandles or average footcandles shown below. These levels shall be shown as initial footcandles. Measured average illumination level shall allow a 10% variance of predicted mean in accordance with IESNA RP-6-01, and be measured at the first 100 hours of operation.

1.4 INSPECTION AND VERIFICATION

1.4.1 Testing Equipment

1.4.1.1 Testing equipment for measurement of foot-candle levels shall be United Technology's Digital Model #61, a Gossen Panalux Electronic 2 or an approved equal, and must show proof of calibration prior to testing as required by manufacturer.

1.4.2 Final Approval

1.4.2.1 At the completion of the project and in the presence of the appropriate parties, actual light performance meter readings shall be taken and verified. Initial light levels and uniformities are guaranteed per specifications at time of initial start up. At 100 hour burn in, light levels will be +-10% on the initial specified light levels per IES RP-6-01.

1.4.2.2 Should the lighting performance not meet the specified criteria, the contractor shall be responsible to bring the lighting system into compliance. Should additional fixtures be required, the contractor shall be responsible for all material and labor, as well as any associated changes in the electrical system and pole/foundation designs. (Results assume +-3% nominal voltage at load side of electrical enclosure, fixtures properly aimed to field and poles located within 3' of design location.)

PART 2 – PRODUCTS:

2.1 LIGHTING SYSTEM CONSTRUCTION

2.1.1 General Description: Basis of design: Musco's Light-Structure Green™ System is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.

2.1.2 Design Approval: The owner / engineer will review pre-bid shop a drawing from the manufacturer's to ensure compliance to the specification. If the design meets the design requirements of the specifications, a letter will

be issued to the manufacturer indicating approval for the specific design submitted.

2.1.3 Lighting system shall consist of the following: Galvanized steel poles and cross-arm assembly

2.1.4 Pre-stressed concrete base embedded in concrete backfill. Alternate may be an anchor bolt foundation designed such that the steel pole and any exposed steel portion of the foundation be located a minimum of 18 inches above final grade. Anchor bolt foundation concrete must cure for a minimum of 28 days before the pole stress is applied. Direct bury steel (including steel pin base) and concrete poles are not acceptable.

2.1.5 All luminaires shall be constructed with a die-cast aluminum housing to protect the luminaire reflector system. If die-cast housing is not available, spun aluminum with a hair shroud is acceptable.

2.1.6 Lamps producing more than 155,000 lumens will not be allowed due to rapid depreciation.

2.1.7 Manufacturer will remote all ballasts and supporting electrical equipment in aluminum enclosures mounted approximately 10' above grade. The enclosures shall include ballast, capacitor and fusing for each luminaire. Safety disconnect per circuit for each pole structure will be located in the enclosure.

2.1.8 Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.

2.1.9 Controls and Monitoring Cabinet to provide on-off control and monitoring of the lighting system constructed of NEMA Type 4 aluminum. Communication method shall be provided by manufacturer. Cabinet shall contain custom configured contactor modules for 30, 60, and 100 amps, labeled to match field diagrams and electrical design. Manual Off-On-Auto selector switches shall be provided.

2.1.10 Service Platforms –Floor of service platform shall be approximately 26 inches by 62 inches for a 2 Light Bar; 26 inches by 115 inches for a 4 Light Bar; and 26 inches by 170 inches for a 6 Light Bar. Centered in the platform shall be an access door hinged to open to the rear. The mounting supports on the platform shall be C3x5 channel and C4x7.25 channel. The floor shall be all welded construction. The back rail and side rails shall be at least 43 inches high. The side rails, back rail, platform, and light bar shall bolt together for one integral unit. The platform shall be fastened to the pole in two places using galvanized threaded rods and galvanized straps. Platform shall be hot-dip galvanized ASTM A123 standards for long-term durability.

2.1.11 Pole Climbing Steps, Safety Cable and Safety Harness – Steel climbing steps shall begin approximately 15 feet above ground and shall be staggered on 15 inch centers to top of pole. Steps shall be grade 5-3/4 inches by 7 inch long round head bolts, hot-dip galvanized meeting ASTM-A307. Bolts shall be fastened to brackets welded to the pole by two ¾ inch square nuts. Poles shall be equipped with 3/8 inch galvanized safety cable at step initiation and attached at top and bottom with welded brackets. An OSHA approved safety harness and climbing device assembly shall be supplied to the owner for use with safety cable assembly attached to the pole.

2.1.12 Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, ballast and other enclosures shall be factory assembled, aimed, wired and tested.

2.1.13 Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed steel shall be hot dip galvanized per ASTM A123. All exposed hardware and fasteners shall be stainless steel of at least 18-8 grade, passivated and polymer coated to prevent possible galvanic corrosion to adjoining metals. All exposed aluminum shall be powder coated with high performance polyester. All exterior reflective inserts shall be anodized, coated with a clear, high gloss, durable fluorocarbon, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.

2.1.14 Lightning Protection: All structures shall be equipped with lightning protection meeting NFPA 780 standards. Contractor shall install ground rod per section.

2.1.15 All system components shall be UL Listed for the appropriate applications.

2.2 STRUCTURAL PARAMETERS

2.2.1 Support Structure Wind Load Strength: Poles and other support structures, brackets, arms, bases, anchorages and foundations shall be determined based on the 2006 edition of the IBC Building Code, wind speed of 90, exposure category C. Luminaire, visor, and cross-arm shall withstand 150 mph winds and maintain luminaire aiming alignment. Foundation design will be based on 2006 IBC.

2.2.2 Structural Design: The stress analysis and safety factor of the poles shall conform to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals 1994.

2.2.3 Soil Conditions: The design criteria for these specifications are based on soil design parameters as outlined in the geotechnical report. If a geotechnical report is not provided by the owner, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2003 IBC, Table 1804.2

2.2.4 Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.

2.2.5 Manufacturer's Warranty – 25 years.

2.2.6 The manufacturer shall warrant the entire lighting system consisting of poles, foundations, luminaire assembly, remote ballast enclosures, wire harnesses and controls/monitoring equipment in writing for a period of TWENTY-FIVE (25) years. Any parts that shall be found defective shall be replaced free of labor charge. Fuses shall not be warranted but shall be provided as needed at no charge to the owner for the 25 year warranty period. The owner will agree to check and change fuses in the event of a lamp outage prior to service work being scheduled.

2.2.7 Aiming, Spill Control and Light Level Warranty

2.2.8 The alignment of the luminaire shall be warranted by the manufacturer against movement on the luminaire assembly for a period of TWENTY-FIVE (25) years from the date of installation. Labor and equipment charges for re-aiming during the warranty period shall be the responsibility of the manufacturer. Spill light levels at pre-determined points shall be guaranteed by the manufacturer to be at the level specified for this project for a period of TWENTY-FIVE (25) years. Readings shall be provided by manufacturer and shall be within the illumination Engineering Society of North America RP-6-01 Standards of +/- 10% of the design criteria.

2.2.9 Manufacturers providing average constant light levels: Average constant light levels shall be guaranteed to meet light levels in section 1.2.2.1 by manufacturer for a period of 25 years within the Illumination Engineering Society of North America RP-6-01 standard of +/-10% of the design criteria. The lamp operation, system performance, and operating hour usage shall be electronically monitored by an internet based control system. This includes on/off status, lamp outages, web site scheduling via phone, fax or email and access to trained staff available 24/7 to provide scheduling support and regular reporting back to the customer should problems occur. All communication and service costs to provide controls and monitoring shall be included in the 25 year warranty. When light levels can no longer be maintained at the constant illumination levels specified above, manufacturer will provide for lamp replacement schedule as outlined below for 5000 hour rated lamps.

2.2.10 Manufactures providing initial/maintained lighting levels: Initial average light levels shall be guaranteed by the manufacturer to meet light levels in section 1.2.2.1 upon 100 hours initial burn in of the lighting system, within the Illumination Engineering Society of North America RP-6-01 standard of +/-10% of the design criteria. The lamp operation, system performance, and operating hour usage shall be electronically monitored by an internet based control system. This includes on/off status, lamp outages, web site scheduling via phone, fax or email and access to trained staff available 24/7 to provide scheduling support and regular reporting back to the customer should problems occur. All communication and service costs to provide controls and monitoring shall be

included in the 25 year warranty. Once light levels reach the targeted maintained light levels specified above. The manufacturer will provide for lamp replacement schedule as outlined below for 3000 hour rated lamps.

2.2.11 Lamp Warranty: Lamps shall be warranted for full replacement cost including labor for 25 years. The expected usage hours for the multipurpose field will be 500 hours per year.

2.2.12 For 5000 hour rated lamps and constant illumination, manufacturer shall re-lamp at year 10 and 20. Individual lamps shall also be replaced at no charge to the owner throughout the warranty period. When individual lamp outages materially impact the playability of a field during the 25-year warranty period, the manufacturer shall at no charge to owner provide, install and re-aim all lamps as needed. For this project, materially impact is defined as more than one lamp per pole or 10% of the total installed lamps on one field.

2.2.13 For 3000 hour rated lamps, manufacturers shall re-lamp at year 7, 14 and 21. Individual lamps shall also be replaced at no charge to owner throughout the warranty period. When individual lamp outages materially impact the playability of a field during the 25-year warranty period, the manufacturer shall at no charge to owner provide, install and re-aim all lamps as needed. For this project, materially impact is defined as more than one lamp per pole or 10% of the total installed lamps on one field.

2.2.14 The manufacturer shall furnish to the owner of the facility 5 extra fuses for future use.

2.2.15 Warranty - The Lighting Contactor Cabinet shall be covered for the warranty specified for the lighting system.

2.3 DOCUMENTATION

2.3.1 Bidders wishing to provide alternate equipment shall submit the following product information 10 days prior to bid:

SUBMITTAL INFORMATION

Design Submittal Data Checklist and Certification
All items listed below are mandatory to comply with the specification

Included	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by, and other pertinent data b. Outline of field(s) being lighted, as well as pole locations referenced to the middle of the field. Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, as well as luminaire information including wattage, lumens and optics d. Height of meter above field surface e. Summary table showing the number and spacing of grid points; average, minimum and maximum

			illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance and uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor. f. Alternate manufacturers shall provide both initial and maintained light scans using a maximum 0.70 Light Loss Factor to calculate maintained values.
	C	Off Field Lighting Design	Lighting design drawing showing maximum initial vertical spill light levels and maximum initial horizontal light levels along the west side at the chain link fence in foot-candles. Vertical levels shall be at 30-foot intervals along the chain link fence and equal 26 points. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank lights.
	d	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Ohio.
	D	Control and Monitoring	Manufacturer shall provide written definition and schematics for automated control system to include monitoring. They will also provide examples of system reporting and access for numbers for personal contact to operate the system.
	E	Electrical distribution plans	If bidding an alternate system, manufacturer must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Ohio.
	F	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed per specification for 25 years.
	G	Warranty	Provide written warranty information including all terms and conditions.
	H	Project References	Manufacturer to provide a list of project references of similar products completed within the past three years.
	I	Product Information	Complete set of product brochures for all components, including a complete parts list and UL Listings.
	J	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications.
	K	Compliance	Manufacturer shall sign off that all requirements of the specifications have been met at that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in item N – Non-Compliance

Manufacturer: _____ **Signature:** _____

Contact Name: _____ **Date:** _____/_____/_____

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260519 - CONDUCTORS, IDENTIFICATION, SPLICING DEVICES & CONNECTORS

PART 1 – GENERAL:

1.1 This section of the Specifications covers all of the electrical power, lighting, and control power (line voltage) conductors, but does not include communications, data or signal system conductors, which are specified separately in these specifications.

1.2 All conduits installed without conductors shall have a 200 lb. test nylon string installed for future use, tied off securely at each end.

1.3 **No more than 40% conduit fill is permitted for any conduit system, including video, intercom, data, power or other signal circuits unless specifically indicated otherwise on the plans.**

1.4 No more than five conductors shall be installed in conduit except for switch legs and travelers in multi-point switching arrangements.

1.5 If circuits originate from data equipment supply panels provided with local surge suppression, the circuit neutral shall not be shared, as in an Edison circuit. Pull separate neutrals for each phase. In these cases, a maximum of seven conductors is permitted in a conduit. Conductors shall be derated per N.E.C.

1.6 If more than three phases are installed in a single raceway, an additional equipment grounding conductor and neutral shall be installed as indicated by the number of phase conductors.

PART 2 – MATERIALS:

2.1 CONDUCTORS

2.1.1 All conductors shall be 98% conductive annealed copper unless otherwise noted, UL listed and labeled.

2.1.2 Lighting and receptacle branch circuits shall be not less than No. 12 copper wire or of the sizes shown on the drawings with Type THW, THHN or THWN insulation. All feeder circuits shall be Type THW or THWN of the size as shown on the Contract Drawings. THHN wiring shall only be installed in overhead, dry or damp locations. THWN or THW wiring shall be used for all circuits pulled in underground or other wet locations.

2.1.3 Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes shall be stranded.

2.1.4 Conductors for fire alarm wiring shall be stranded and in full compliance with N.E.C. 760. All fire alarm conductors shall be installed within conduit and enclosed junction boxes.

2.1.5 All wire on the project shall be new, in good condition, and shall be delivered in standard coils or reels.

2.1.6 The color of the wire shall be selected to conform with Section 210-5 of the latest edition of the National Electrical Code. Refer also to 260519-PART 4, Color Coding.

2.1.7 All equipment grounding conductors shall have green color insulation or if larger than #8, shall be taped for two inches, green color at every termination and pullbox access point.

2.1.8 Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible.

2.1.9 Conductors for main ground from neutral bus, equipment grounding bus, building steel, grounding grid and main cold water pipe connection shall be bare copper.

2.1.10 All conductors shall be identified by color code and by means of labels placed on conductors in all junction boxes and at each terminal point with Brady, Ideal, T & B or approved equivalent labels indicating source, circuit No. or terminal No.

2.1.11 Branch wiring and feeder conductors that are greater than 100' in length shall be increased at least one size to compensate for voltage drop. All circuits shall be installed and sized for a maximum 2% voltage drop.

2.2 SPLICING DEVICES & CONNECTORS

2.2.1 Splicing devices for use on No. 14 to No. 10 AWG conductors shall be pressure type such as T & B "STA-KON", Burndy, Reliable or approved equivalent.

2.2.2 Wire nuts shall be spring pressure type, insulation 600V, 105°C insulation, up to #8 size. Greater than #6 Cu shall be a compression type connection, 600V insulation, cold shrink tubing, taped to restore full insulation value of the wire being spliced.

2.2.3 Pressure crimp-applied ring type (or fork with upturned ends) terminations shall be employed on motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using No. 10 AWG or smaller conductors.

2.2.4 Splices, where necessary, shall be made with hydraulically-set "Hy-press" or equivalent crimped connectors. All splices shall be insulated to the full value of the wiring insulation using a cold-shrink kit or the equivalent in built-up materials.

2.2.5 Large connectors (lugs) at terminals shall be mechanical type, hex-head socket or crimp-on style, installed per the manufacturer's recommendations.

2.2.6 Exterior underground connections made between bare ground wires or to ground rods shall be exothermically welded, "Cadweld" or equivalent.

2.2.7 The use of split-bolt clamps will be permitted in wireways at service entrance only. Torque to 55 foot-pounds or as recommended by manufacturer.

2.2.8 No aluminum conductors shall be used.

PART 3 – INSTALLATION:

3.1 The pulling of all wires and cable on this project shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.

3.2 The radius of bending of conductors shall be not less than eighteen times the outside diameter of the conductor insulation or more, if recommended by the manufacturer.

3.3 Conductors installed within environmental air plenums shall be per N.E.C. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent.

3.4 Where indicated, communications conductors that are installed exposed shall not be routed across ceilings or ductwork. They shall be held up against building structure or against permanent support members. They shall be installed in such a manner that they do not interfere with the access to or operation of equipment or removal of ceiling tiles. Nylon tie-wraps shall be installed in such a manner so as to bundle

conductors neatly, allowing runouts of single conductors or groups to drop down to equipment served. Install grommeting where dropping out of trays or into panels or service columns. Install sleeves with bushings where penetrating partitions. Firestop sleeves with approved material. Do not penetrate firewalls if so indicated on plans. Refer to the drawings for support requirements and details on routing exposed communications conductors.

3.5 Conductors for isolated power systems shall be installed in as short a run of conduit as practicable. No pulling soap shall be used on conductors in isolated power systems.

3.6 Where conductors are installed in industrial facilities, they shall be per J.I.C. standards.

3.7 Maximum permissible pulling tensions, as recommended by the manufacturer for any given type of cable or wire installed shall not be exceeded. Utilize special remote readout equipment as required to ensure compliance. Use particular caution when installing twisted pair data cable or fiber optic cables -- forces permitted for pulling in are typically very low for these cable types.

PART 4 - COLOR CODING DISTRIBUTION VOLTAGE CONDUCTORS, 600 VOLT OR LESS:

4.1 Conductors to be color coded as follows:

4.1.1 120/208 Volt Conductors
Phase A - Black
Phase B - Red
Phase C - Blue
Neutral – White

4.1.2 277/480 Volt Conductors
Phase A - Brown
Phase B - Orange
Phase C - Yellow
Neutral - Gray, or white with brown tracer

4.1.3 Isolated Power Conductors (Type XLP or XHHN)
Phase A - Brown
Phase B - Orange
Phase C - Yellow
Neutral - White with brown tracer stripe

4.1.4 Note: Further identify isolated power conductors with ½" wide purple tape at all terminations and junctions.

4.1.5 Control Wiring - Red, or as indicated.

4.1.6 Conductors within enclosures that may be energized when enclosure disconnect is off - yellow, or taped with ½" yellow tape every 6" of length, inside enclosure. Provide lamacoid plate warning sign on front of enclosure where this condition occurs.

4.1.7 D.C. Wiring - Positive - Light Blue
Negative - Dark Blue

PART 5 - COMMUNICATIONS CONDUCTORS:

5.1 Communications conductors shall be of type suitable for the service, installed in accordance with the manufacturer's recommendations for pulling tensions, support, terminations, proximity to high power

fields, etc. Types not indicated on this schedule but indicated on plans shall be as noted or required for the service. If in doubt, contact the Engineer for clarification.

5.2 Plenum-rated conductors (per N.E.C.) shall be installed where required by codes. If installation is thru an approved raceway system that excludes the wiring from the plenum, non-plenum type may be used.

5.3 All communications cables shall be furnished and installed in compliance with U.L. 444, U.L. 13, N.E.C. 800, 725, 760 and all applicable codes and standards, for premises or riser installations.

5.4 Riser cables shall be provided in accord with current edition of the N.E. Code.

5.5 Schedule of Wiring Types - Plenum-Rated

Data Circuits	24 AWG, 4 Pair Certified Category Five U.T.P. Plenum-Rated	Anixter #CMP-00424 FAS-5B Belden Equivalent Berk-Tek Equivalent A.T.&T. Equivalent
Voice Circuits	24 AWG, 4 Pair Certified Category Five U.T.P. Plenum-Rated	Anixter #CMP-00424 FAS-5B Belden Equivalent Berk-Tek Equivalent A.T.&T. Equivalent
Voice Circuits	24 AWG, 4 Pair Category Three U.T.P. Plenum-Rated	Anixter #CMP-00422 HAH-3 Belden Equivalent W.P.W. Equivalent
Video Drops	RG-6/U Coaxial, 18 AWG Solid Conductor, Plenum-Rated	Belden #89120 Anixter Equivalent Berk-Tek Equivalent
Video Trunks	RG-11/U Coaxial, 14 AWG Solid Conductor, Plenum-Rated	Belden #89292 Anixter Equivalent Berk-Tek Equivalent
T-1 Premises Extension Cable	T-1, 4 Pair 22 AWG, Plenum-Rated Pairs Individually Shielded	Anixter #CMP-00422T1-3 Belden Equivalent Berk-Tek Equivalent
12-Strand Fiber (or # of Strands as Noted)	Multimode 62.5/125 Micron, Plenum-Rated	Anixter #370-949-FDDI-12 Siecor Equivalent Berk-Tek Equivalent
Speaker Cable	22 AWG. 1 Pair Shielded	Belden #88761 W.P.W. Equivalent Anixter Equivalent
Speaker Cable, with Call-In Unshielded Pair	22 AWG. 1 Pair Shielded, 1 Pair 22 AWG. Unshielded	Belden #88723 W.P.W. Equivalent Anixter Equivalent
100 Pair Telephone Cable	24 AWG. 100 Pairs, Non-Plenum Exchange Cable, Wet Location Rated, Gel-Filled Certified Category Three	Anixter #E-010024DFC Belden Equivalent A.T.&T. Equivalent

OR

A. Schedule of Wiring Types - Non-Plenum Rated

Data Circuits	24 AWG, 4 Pair Certified Category Five U.T.P.	Anixter #CM-00424 CAG-5B Belden Equivalent Berk-Tek Equivalent
Voice Circuits	24 AWG, 4 Pair Certified Category Five U.T.P.	Anixter #CM-00424 CAG-5B Belden Equivalent Berk-Tek Equivalent
Voice Circuits	24 AWG, 4 Pair Category Three U.T.P.	Anixter #CM-00422 BAG-3 Belden Equivalent W.P.W. Equivalent
Video Drops	RG-6/U Coaxial 18 AWG Solid Conductor	Belden #9060 Anixter Equivalent W.P.W. Equivalent
Video Trunks	RG-11/U Coaxial, 14 AWG Solid Conductor	Belden #1523A Anixter Equivalent W.P.W. Equivalent
T-1 Premises Extension Cable	T-1, 4 Pair 22 AWG, Pairs Individually Shielded	Anixter #CM-00422 MIGT-3 Belden Equivalent Berk-Tek Equivalent
12-Strand Fiber (or # of Strands as Noted)	Multimode 62.5/125 Micron	Anixter #370-647-FDDI-12 Siecor Equivalent Berk-Tek Equivalent
Speaker Cable	22 AWG. 1 Pair Shielded, Plenum-Rated, Stranded	Belden #9414 Equivalent W.P.W. or Anixter
Speaker Cable with Call-In Pair	22 AWG. 1 Pair Shielded, 1 Pair 22 AWG. Unshielded for Call-In, Plenum-Rated	Belden #8730 W.P.W. Equivalent Anixter Equivalent
100 Pair Telephone Cable	24 AWG. 100 Pairs, Non-Plenum Exchange Cable, Wet Location Rated, Gel-Filled, Certified Category Three, Installed in Metal Conduit	Anixter #E-010024DFC Belden Equivalent A.T.&T. Equivalent

PART 6 - HIGH VOLTAGE PRIMARY CABLE:

6.1 High voltage primary cable shall be rated for aerial, direct burial, open tray, wet location and submersible underground service. Cable shall be I.P.C.E.A. - listed and UL listed for the use indicated.

6.2 Cable shall be rated 15 K.V., nominal. Insulation shall be XLP, XLPE or approved equivalent with a nominal 133% value.

6.3 Cable shall be shielded, grounded, with extruded 8 mil. semiconducting layer bonded to the insulation. Provide with copper drain wires served over semiconducting layer.

6.4 Cable shall be installed in accordance with manufacturer's recommendations, with particular attention to termination, handling, bending radii and pull tension recommendations.

6.5 The conductor shall be copper with Class "B" stranding per ASTM B-8.

6.6 Cable shall be as manufactured by G.E., Anaconda, Phelps-Dodge, Okonite, or approved equivalent.

6.7 Cable shall be manufactured per the following standards: UL 1072 and ICEA for medium voltage cable.

6.8 Cable shall be terminated at pad-mount transformer or as indicated with pre-manufactured load-break, dead-front elbows and fittings compatible with cable and rated for the purpose. Pre-manufactured elbows and other types of fittings indicated shall be as manufactured by Elastimold Co., Blackburn-ITT, R.T.E. Corporation, S & C Company or other approved equivalent.

6.9 Cable terminators for 15 K.V., 200 ampere connection shall be ANSI Standard 386-1877 200 amp hot-stick operable load break elbow with voltage test point. The elbow shall be furnished with the necessary cable adapter for terminating the copper cable used.

6.10 Electrical ratings shall be as follows:

6.10.1 Voltage 15 KV class

6.10.2 Continuous and Load Break Current 200 amps, rms

6.10.3 BIL 95 KV

6.10.4 Withstand Voltage (AC) 34 KV, 60 HZ, 1 minute

6.10.5 Short-Time Current 10,000 amps, rms, sym.,.17 seconds.

6.11 Cable terminators for 15 K.V., 600 ampere connection shall be ANSI Standard 368-1977 premolded dead break unit for terminating 15 KV shielded cable. The connector shall be fully shielded, of dead front operation and shall be fully submersible. The connector shall be furnished with proper adapters for terminating the copper cable used.

6.12 The connectors shall have the following ratings:

6.12.1 Voltage 15 KV Class

6.12.2 Continuous Current 600 amps, rms

6.12.3 BIL 95 KV

6.12.4 8 Hour Overload 900 amps, rms

6.12.5 Withstand Voltage (AC) 35 KV, 60 Hz, 1 minute

6.12.6 Momentary 25,000 amps, rms, sym, .17 seconds.

6.13 Cable shall be color coded at all terminations and junctions as follows:

6.13.1 Phase A - Black
Phase B - Red
Phase C – Blue

6.14 Follow the above color coding unless otherwise indicated or required by system user.

6.15 Cable grounding at all terminations shall be in accord with the manufacturer's recommendations and applicable codes.

6.16 A full size (matching phase conductors) copper 600 volt insulated ground is to be provided with each primary circuit.

6.17 Installation, termination and testing of primary power cables shall be accomplished by Journeymen Electricians with at least three years experience with such work.

6.18 In lieu of using pre-manufactured elbows and other fittings, installer may substitute field-build and taped stress cones or other type of termination, subject to written prior approval of the engineer. In requesting such approval, submit complete data on materials proposed to be used and tools to be used in cutting and stripping cable.

6.19 All new primary cable shall be high-potential tested in accord with criteria outlined herein. Where taps, splices or terminations to existing primary cables are indicated on the plans, the Engineer reserves the right to request high-potential testing of the existing cable or systems to determine their suitability and safety, if not so indicated on the plans.

6.20 Always field verify exact primary power voltage potentials with the supplying utility and report any discrepancy from that indicated on the plans to the Engineer prior to placing any primary cable in service.

PART 7 - TESTING OF PRIMARY CABLE:

7.1 All new primary cable shall be tested prior to energization in accord with the following criteria, or other approved method.

7.1.1 Use equipment made by one of the following (or approved equivalent) and abide by their operation rules for their respective equipment:

7.1.1.1 Associated Research, Inc

7.1.1.2 J.G. Biddle Company

7.1.1.3 Hipotronics, Inc.

7.1.1.4 Von Corporation

7.1.2 Clear cable of all equipment, switchgear, etc. for elbows, install insulation plugs. On cable end, insulate by high voltage taping, insulating jar or plastic. All terminations and splices shall be completely and properly grounded. All adjacent equipment shall be grounded, where danger of flashover exists.

7.1.3 A sphere gap in parallel with the 100,000 volt D.C. "Hipot" tester shall be calibrated for sparkover at 70 KV D.C.

7.1.4 The direct current test voltage shall be applied in increments of 5 KV and shall be left at the step for 1 minute. Saturate cable for 15 minutes at test voltage as in (5) below.

7.1.5 Test: (as appropriate)

7.1.5.1 15 KV cables with open terminations at 55 KV D.C.

7.1.5.2 15 KV cables with elbow termination at 45 KV D.C., or to the limit of the elbow or splice. Verify with manufacturer.

7.1.5.3 SPECIAL NOTE: It is suggested that tests be performed when relative humidity is 50 to 60% or less in clear, dry weather for greater safety.

7.1.6 Record the leakage current at each step and at end of saturation time.

7.1.7 Acceptance: The above procedure with less than 100 microamperes of current registered.

7.1.8 Proof test on existing cable at 35 KV for 5a and 35 KV for 5.2 above.

7.1.9 After test (in order listed):

7.1.9.1 Turn tester power off.

7.1.9.2 Discharge tester and cable thru a resistive discharge device (8 MEGOHM discharge stick).

7.1.9.3 Ground cable thru a grounding means (#12 AWG THW wire to ground).

7.1.9.4 Disconnect tester.

7.1.10 For Safety:

7.1.10.1 Wear high voltage gloves at all times.

7.1.10.2 Treat cable and tester as high voltage at all times.

7.1.10.3 Remember, D.C. static charges can be very harmful.

7.1.11 All tests must be made in the presence of the Engineer and shall be recorded on a form sheet signed by the person performing the test and dated. Three (3) copies shall be submitted to the Engineer. Provide 48 hour advance written notice to Engineer.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260526 - GROUNDING

PART 1 – GENERAL:

1.1 All metallic conduit, raceways, cable trays, wireways, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code, as shown on the Contract Drawings and in accord with the requirements of the local authority having jurisdiction, as applicable.

1.2 The size of the equipment grounding conductors, grounding electrode conductors and service grounding conductors shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings. Where ungrounded conductor sizes are increased to minimize voltage drop, grounded conductor sizes shall be increased in the proper proportion.

1.3 Grounding bus and non-current carrying metallic parts of all equipment and raceway systems shall be securely grounded by connection to common ground.

1.4 The service entrance main ground bus shall also be connected to the main cold metallic water pipe within three feet of where it enters the building, on both the house and street sides of the main shut-off valve with a properly sized bonding jumper. A properly sized bonding jumper shall also be provided to the frame of any steel structure utilized in the construction. The steel frame of the building (if any) shall be made electrically continuous.

PART 2 – MATERIALS:

2.1 Ground wires and cables shall be of the AWG sizes shown on the Contract Drawings or shall be sized in accord with the prevailing codes. All ground wires and cables shall be copper.

2.2 All grounding fittings shall be heavy cast bronze or copper of the mechanical type except for underground installations or interconnection of grounding grid to cable, columns and ground electrodes, which shall be thermically welded type as manufactured by Cadweld, Burndy Co., Therm-O-Weld, or approved equivalent.

2.3 Other bonding clamps or fittings in above ground locations shall be as manufactured by O.A. Co., T & B, Burndy, or approved equivalent.

2.4 Ground electrode pipe systems shall be solid copper construction. Ground rods shall be 5/8" minimum diameter, eight feet long, copperweld steel. All ground electrode systems shall be installed in accord with manufacturer's recommendations, U.L. listings, National Electrical and National Electrical Safety Codes.

PART 3 – INSTALLATION:

3.1 All grounding conductors shall be protected from mechanical injury and shall be rigidly supported. Where ground conductors are run through flexible conduit and through panelboard switchboard or motor control center feeders, they shall be securely bonded to such conduit thru the use of grounding bushings at the entrance and exit. All connection of equipment shall be made with an approved type of solderless connection and same shall be bolted or clamped to equipment or conduit.

3.2 All equipment grounding conductors to lighting fixtures, devices, receptacles, electric heaters, furnace and other equipment not exceeding No. 8 AWG in size shall be green colored Type "THWN".

3.3 Equipment ground connections to GFI circuit breakers shall be carried and bonded to each outlet on the circuit. Provide a separate equipment grounding conductor with green color insulation.

3.4 Resistance to the grounding at the service entrance equipment shall be in accordance with the N.E.C. for style of construction and shall not exceed ten ohms as measured by the described testing method.

3.5 All circuits shall have a separate grounding conductor, except as otherwise noted.

3.6 When grounding systems are completely installed and all grading in the area of the service grounding electrode has been completed up to finish elevations, perform a fall-of potential or other approved test to determine actual system resistance to earth. Report results to the Engineer in writing. Refer to testing provisions in this section of specifications.

3.7 Where separately-derived systems are utilized as part of the power distribution network, the neutral leg of the secondary side of generators, transformers, etc., shall be connected to a grounding electrode in accordance with the manufacturer's recommendations.

3.8 The Contractor shall ensure that the ground return path thru building structural steel or other means is electrically continuous back to the service grounding electrode and is of adequate capacity and impedance to carry the maximum expected fault or other current. Where no electrically continuous steel building frame is available, the Contractor shall provide a properly sized ground bar and ground conductor routed back to the main facility ground bus.

3.9 Where a building's steel frame is made electrically discontinuous by masonry breaks (as at firewalls, etc.), the Contractor shall provide an accessible thermically welded bonding jumper of #500MCM copper to bond the building steel frame sections together, making the entire steel frame electrically continuous. The installation of these bonding jumpers shall be reviewed by the Engineer prior to their being covered by construction.

3.10 Where lightning protection systems are utilized on the work, their electrodes and conductors shall be electrically segregated from the building service ground, except where connections to structural elements are required for the proper installation of these systems. Lightning protection grounds shall only be utilized for lightning grounding applications, in accord with U.L. and manufacturer's recommendations.

3.11 Grounding connections shall **never** be made to fire protection, natural gas, flammable gas or liquid fuel piping, except where specifically indicated on the plans.

3.12 Where dielectric fittings are utilized in piping systems, the piping system shall **not** be utilized as a ground path. Bonding jumpers shall not be utilized to bridge over such fittings. Piping systems shall not be utilized as ground paths except where specifically required by codes in the case of water piping.

PART 4 - GROUNDING ELECTRODE SYSTEM:

4.1 The ground electrode system shall be as specified herein. The system shall not require maintenance throughout the expected life span of the materials.

4.2 Ground system shall be an electrolytic rod type, as manufactured by Lyncole XIT Grounding, Superior Grounding Systems, L.E.C., Inc. (Chem-Rod), or approved equivalent. Electrode(s) shall be placed as shown on the plans, installed exactly per manufacturer's recommendations. Electrodes shall be installed vertically, 12 feet of overall length (or length as indicated), set in a drilled hole and backfilled per manufacturer's instructions with a special clay slurry surrounding the rod. Provide a concrete protection box with cast iron grate for the top of the rod termination. Ground system shall be per the following:

4.2.1 Manufacturer: Lyncole XIT Grounding (or approved equivalent).

4.2.2 Source: Lyncole XIT Grounding, 22412 S. Normandie Ave., Torrance, CA 90502 1-800-962-2610

4.2.3 Shaft Configuration: Straight.

4.2.4 Shaft Length: 12 feet (or as otherwise indicated).

4.2.5 Listings: U.L.-467J, ANSI 633.8.

4.2.6 Material: Type K Copper.

4.2.7 Construction: Hollow tube, 2.125" O.D., chemical filled with non-hazardous metallic salts.

4.2.8 Weight 3.5 lbs. per foot of length, nominal.

4.2.9 Ground Wire Termination: Exothermic ("Cadweld" by Contractor) connection to 4/0 conductor, with U-bolt with pressure plate provided as test point.

4.2.10 Average Life Expectancy: 25 Years.

4.2.11 Model Number: K2-(length)CS.

4.2.12 Provide grounding system with the following components: protective box, backfill material. Box to be concrete with cast iron, tamper-resistant lid, backfill to be "Bentonite" clay.

4.3 Installation of Pipe Ground System:

4.3.1 Pipe ground systems shall be installed exactly as required by the system manufacturer. The Contractor shall be diligent to observe the excavation, sealing tape removal, slurry backfill and all other critical requirements.

4.3.2 **Note: NEVER USE SAND OR ORDINARY EARTH AS A BACKFILL MATERIAL**

4.3.3 Pipe grounding system shall be warranted unconditionally by the Contractor for a period of one year from the date of substantial completion.

PART 5 - GROUND TESTING PROCEDURE:

5.1 The actual resistance to earth of the service grounding electrode shall be measured by the Contractor via the fall-of-potential method. This testing shall be accomplished after the grounding electrode has been completely installed and the finished grade is achieved.

5.2 The results of the testing shall be summarized in a written report by the Contractor, which shall be forwarded to the Engineer for review. The report shall also be included with the operation and maintenance manuals for the Owner's information and future reference. This report is to also contain a detailed description and illustrations of the testing procedure, along with the name and model number of the testing instrument(s).

5.3 For the actual testing, the Contractor shall follow the procedures outlined below. A self-contained instrument such as a "Megger" or "Ground OHMMETER" shall be used that is designed to eliminate the influence of stray current effects on the accuracy of the measurements.

5.3.1 Connect one side of the instrument to the grounding electrode conductor where it connects to the facility main ground bus (point C1). Disconnect and isolate the grounding electrode conductor for the test.

5.3.2 Drive a copperweld reference electrode probe (point C2) into earth between 300 and 500 feet away from C1 and connect to measurement instrument.

5.3.3 Drive the movable grounding probe (C3) into earth at ten equally spaced intervals, in a straight line between C1 and C2 points and note the E/I=R resistance readings on a graph at each point.

5.3.4 The resistance measurements in OHMS taken from the flat part of the curve shall be averaged to determine the true grounding electrode resistance to earth.

5.3.5 At completion of testing, remove reference electrode C2 and all temporary wiring and connections.

5.4 If actual measurements of grounding electrode indicate a resistance greater than five OHMS, contact the Engineer for instructions. If deemed necessary by the Engineer, additional electrodes shall be placed and the measurement process repeated until the desired ground potential achieved.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260531 - CABINETS, OUTLET BOXES & PULL BOXES

PART 1 – GENERAL:

1.1 This section of the specifications covers all electrical cabinets, outlet boxes and pull boxes.

1.2 Continuous runs of conduit shall have pull boxes at least each eighty-five (85) feet of run, or as near as possible to that limit.

PART 2 - MATERIALS & INSTALLATION:

2.1 Cabinets, Outlet & Pull Boxes:

2.1.1 Cabinets for lighting and power, telephone, pull boxes, outlet boxes, or any other purposes specified or shown on the Contract Drawings, shall be constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Boxes assembled with sheet metal screws will not be accepted

2.1.2 All cabinets and boxes for NEMA 1 and 1A application shall be provided with knockouts, as necessary, or shall be cut in the field by approved cutting tools which will provide a clean, symmetrically cut opening. All boxes, except panelboards, shall be provided with code gauge fronts with hex head or pan head screw fasteners. Outdoor cabinets shall be hinged cover with pad locking provisions. Fronts for panelboards shall be as specified for panelboards.

2.1.3 Ceiling outlet boxes shall be galvanized steel, 4" octagonal, not less than 2 1/8" deep, with lugs or ears to secure covers, and those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable. Provide adequate support with at least a 2 x safety factor for the anticipated fixture weight.

2.1.4 Special size concealed outlet boxes for clocks, speakers, alarms, TV, etc., shall be provided by the manufacturer of the equipment.

2.1.5 Floor outlet boxes shall be as specified in Section 262726, fully adjustable unless noted or specified otherwise.

2.1.6 Unless otherwise noted on the drawings or in the specifications, outlet boxes shall be installed at the following heights to center of box:

2.1.6.1	Wall Switches, Control Stations	4'-0"
2.1.6.2	Convenience Outlets	l'-6"
2.1.6.3	Convenience Outlets - Above Counters	Bottom at 2" above top of backsplash
2.1.6.4	T.V. Outlets	l'-6"
2.1.6.5	T.V. Outlets - At Wall Brackets	7'-2"
2.1.6.6	Desk Telephones	1' -6"
2.1.6.7	Wall-Mounted Telephones	4'-6"

2.1.6.8	Weatherproof Outlets	2'-2"
2.1.6.9	Disconnects, Branch Panelboards	5'-0" max. to centerline
2.1.6.10	Fire Alarm Man. Stations	3'-6"
2.1.6.11	Fire Alarm Horns	80" AFF or 6" below ceiling, whichever is lower

2.1.7 The location of outlets, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon this Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to make his work fit the work of others and in order that when the fixtures are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture or layout shall be coordinated with and approved by the A-E before this change is made.

2.1.8 All outlets, pull boxes, junction boxes, cabinets, etc., shall be sized per the current edition of the National Electrical Code.

2.1.9 Cabinets, outlet boxes and junction or pull boxes shall be threaded for rigid-threaded conduit, dust-tight vapor-tight or weatherproof as required for areas other than for NEMA 1 or 1A application. These shall be as manufactured by Crouse-Hinds, Appleton, Killark, or approved as equivalent.

2.1.10 NEMA 1 or 1A cabinets, outlet boxes or pull or junction boxes shall be as manufactured by Appleton, Steel City, T & B, or approved equivalent.

2.1.11 Outlet boxes for switches, receptacles, telephone, etc., concealed in walls shall be galvanized steel, 4" X 4" X 2-1/8" with plaster cover for the number of devices as required and to be flush with finished wall. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or other masonry which will not be covered with plaster or in walls covered by wood wainscot or paneling, deep sectional masonry boxes shall be used and they shall be completely covered with the plates or lighting fixtures. This Contractor shall cooperate with the brick layers, block layers and carpenters to insure that the outlet boxes are installed straight and snugly in the walls. Receptacles shall be set vertically in walls.

2.1.12 Outlet boxes mounted in glazed tile, brick, concrete block or other types of masonry walls shall be mounted above or below the mortar joint. Do Not Split The Mortar Joint.

2.1.13 Boxes for more than two devices shall be for number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.

2.1.14 Outlets provided shall have only the holes necessary to accommodate the conduit at the point of insulation and shall be rigidly secure in position. Boxes with knockout removed and openings not used shall be replaced or provided with a listed knockout closure.

2.1.15 Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.

2.2 SPECIAL NOTICE

2.2.1 Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260533 - RACEWAYS & FITTINGS

PART 1 – GENERAL:

1.1 This section is intended to specify the raceways, conduit, conduit fittings, hangers, junction boxes, splice boxes, specialties and related items necessary to complete the work as shown on the drawings and specified herein.

1.2 This section specifies basic materials and methods and is a part of each Electrical Section that implies or refers to electrical raceways specified therein.

1.3 The types of raceways specified in this section include the following:

1.3.1 Steel electrical metallic tubing. (E.M.T.)

1.3.2 Rigid galvanized steel conduit. (G.R.S.)

1.3.3 Intermediate metal conduit (I.M.C.).

1.3.4 Rigid aluminum conduit.

1.3.5 Flexible metal conduit (aluminum or steel)

1.3.6 Liquid - tight flexible metal conduit.

1.3.7 Rigid nonmetallic conduit.

1.3.8 Surface metal raceways.

1.3.9 Wireways, wall ducts and trench ducts.

1.3.10 Cable tray or cable trough.

1.3.11 Duct banks, and their construction.

1.4 All raceways, as listed in 1.3 above and otherwise specified herein shall be provided in compliance with latest editions of all applicable U.L., NEMA, N.E.C. and A.N.S.I. standards. All conduit, raceways and fittings shall be Underwriters Laboratories listed and labeled, or bear the listing of an agency acceptable to the local authority having jurisdiction.

1.5 Conduit and raceways, as well as supporting inserts in contact with or enclosed in concrete shall comply with the latest edition of all A.C.I. standards and the equipment manufacturer's recommendations for such work.

1.6 P.V.C. or other non-metallic conduit shall be rated for the maximum operating temperature that could be developed by the conductors it encloses, while in normal operation.

1.7 The decision of the Engineer shall be final and binding in any case where a question or inquiry arises regarding the suitability of a particular installation or application of raceways, supports or materials, if other than outlined herein.

1.8 Minimum size of conduit shall be ½ " trade size, except where installed in inaccessible locations, in which case a ¾ " minimum trade size shall be used, unless otherwise noted on the drawings. Switch legs may be

½ " trade size. All conduit and raceways shall be sized for the number of conductors contained, in accord with the latest edition of the National Electrical Code or any other applicable standards.

1.9 The installer of raceway systems shall avoid the use of dissimilar metals within raceway installations that would result in galvanic-action corrosion.

PART 2 – MATERIALS:

2.1 STEEL ELECTRICAL METALLIC TUBING

2.1.1 Electrical metallic tubing, (E.M.T.) of corrosion-resistant steel construction shall be permitted for concealed installation in dry interior locations. Electrical metallic tubing shall not be installed in concrete slabs or where exposed to physical damage. Electrical metallic tubing shall be permitted for exposed work in mechanical and electrical rooms and other exposed structure areas where not subjected to physical damage, as determined by the Engineer.

2.2 RIGID GALVANIZED STEEL CONDUIT

2.2.1 Rigid galvanized steel conduit shall be used where subject to physical damage for exposed work in mechanical spaces, within factory or other industrial work areas, for exposed fit-up work on machinery, for exposed exterior damp or wet location work, in hazardous atmospheres, in exterior underground locations where installed beneath roadways, where ells occur in underground P.V.C. conduits, or where turning out of concrete encased duct banks, and at other locations as specifically called out on the drawings.

2.2.2 Rigid galvanized steel conduit shall be used for all building interior power wiring for cables of over 600 Volts.

2.3 INTERMEDIATE METAL CONDUIT

2.3.1 Unless otherwise indicated on the drawings, intermediate metal conduit (I.M.C.) may be used in any location in place of rigid galvanized steel conduit, as permitted by codes, and as approved by the Engineer.

2.4 RIGID ALUMINUM CONDUIT

2.4.1 Rigid aluminum conduit, shall be permitted for installation indoors in dry locations only. Under no conditions shall it be cast into concrete slabs or pass thru construction where prolonged contact will degrade the aluminum. All ells used in rigid aluminum conduit systems shall be rigid galvanized steel.

2.5 FLEXIBLE METAL CONDUIT

2.5.1 Flexible conduit may be used where permitted by NEC and these specifications. It shall be constructed of steel. It shall be installed with connectors designed for the purpose. All flexible metal conduit shall be installed as a single piece. No joints shall be installed. Flexible conduit shall not be used in wet or dusty locations or where exposed to oil, water or other damaging environments. An equipment grounding conductor or bonding jumper shall be used at all flexible conduit installations. Flexible metal conduit shall not be used in lengths over six feet.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

2.6.1 Weatherproof flexible metal conduit shall be wound from a single strip of steel, neoprene covered, equivalent to "Liquatite" or "Sealtite" Type "UA". It shall be installed in such a manner that it will not tend to pull away from the connectors. Provide strain relief fittings equivalent to "Kellems" as required where subject to vibration. Flexible connections to motors in dusty areas shall be dust-tight, in areas exposed to the weather - weatherproof.

2.7 RIGID NON-METALLIC CONDUIT

2.7.1 Rigid non metallic conduit shall be constructed of P.V.C, nominally schedule 40 weight, except where encased in concrete, where it may be "EB" type. If installation will enclose utility company provided conductors, verify exact type required. and install in accord with their standards, where more stringent than this specification in normal building conditions.

2.7.2 Rigid non-metallic conduit may be used in exterior wet or damp locations where installed underslab or underground. It shall not be run in interior locations, except with special permission from the Engineer for use in corrosive environments, and then only if protected from physical damage. No rigid nonmetallic conduit may be installed in environmental air plenums or cast into above-grade concrete slabs. No rigid nonmetallic conduit may be installed in locations where the ambient temperature might exceed the rating of the raceway.

2.7.3 Where rigid non metallic conduit is placed underground, as for feeder circuits, secondaries or branch circuit runs and where ell is made upward thru a slab on grade, transition the turning ell and the riser to rigid steel conduit to a height of 6" above the concrete slab. Transition may then be made to E.M.T or other approved conduit for remainder of run.

2.7.4 Flexible nonmetallic conduit shall not be used, except by special permission, obtained in writing from the Engineer.

2.7.5 Provide equipment grounding conductors of copper, sized as required by codes, in all circuits installed in rigid nonmetallic raceways.

2.8 SURFACE METAL RACEWAYS

2.8.1 Surface metal raceways shall be constructed of code gauge corrosion-resistant galvanized steel or aluminum extrusions, and finished in an ivory, buff or grey color as selected by the Architect. Finishes shall be suitable for field painting, prepared by the installing contractor as necessary.

2.8.2 Surface metal raceways, where used as raceways only, shall be sized for the conductors indicated. Nominal minimum size of such raceways shall be equivalent to Wiremold Co. Series #700, or equivalent by Walkerduct, Isotrol or other approved manufacturer.

2.8.3 Surface metal raceways to be furnished with integral receptacles shall have Simplex Nema 5-20R outlets spaced on centers as indicated on plans. These shall be Wiremold Co. #2200 Series or equivalent Walkerduct, Isotrol or other approved manufacturer.

2.8.4 Surface metal raceways and all components and fittings shall be furnished by a single manufacturer, wherever practical. All trim and cover fittings, flush feed boxes, splices, outlet fittings, etc, necessary for a complete installation shall be provided by the installing contractor. These raceways shall be rigidly mounted with approved fasteners on not to exceed 24" centers in a run, or 6" from ends and on either side of a corner. Refer to plans for notations on exact types of these raceways and outlet configurations.

2.9 WIREWAYS, WALL DUCT, FLUSH FLOOR TRENCH DUCT

2.9.1 WIREWAYS

2.9.1.1 Wireways of painted steel construction shall be corrosion-resistant, moisture and oil resistant where indicated or necessary. Wireways shall be furnished in norminal sizes of 2 ½ " X 2 ½ ", 4" X 4", 6"" X 6", 8" X 8" or 12" X 12", as indicated on plans. Furnish with hinged covers on all runs and removable covers on all fittings, to allow a continuous unobstructed path for conductor installation. Provide knockouts on all runs, unless otherwise indicated or prohibited by codes.

2.9.1.2 Provide wireways with hangers of same manufacturer, installed so as to allow unobstructed access to wireway interior. Install at not to exceed 8'-0" centers, closer as needed at fittings and turns. Use ¼ " rod hangers minimum for up to 4"X 4", 3/8 " rod minimum up to 8"X 8", ½ " rod minimum for 12" X 12".

2.9.1.3 Wireways shall be equivalent to Square "D" Co. "LD" series, as a minimum standard of construction and quality.

2.9.2 WALL DUCTS

2.9.2.1 Where wall duct type raceways are indicated to be installed flush, they shall be a minimum 3 ½ " deep by 10" wide (or 18" width, as indicated), furnished with screw covers to overlap flange 1" on each side. Covers shall be furnished in nominal 3'-0" lengths. Provide fully grommeted openings or bushed nipples as needed in coverplates to pass cables thru. Where indicated or required, provide transition fittings between horizontal runs of wireway and wall ducts to properly interface each raceway system.

2.9.2.2 Where wall ducts are installed flush either vertically or horizontally as a collector duct, provide proper blocking and support in stud walls, adding a layer of studs as needed to prevent undercutting major structural elements of walls. Trim flange shall be set tight to wall surface with 1/16" tolerance each way.

2.9.2.3 Wall ducts, if indicated to be surface mounted, shall be furnished with flangeless coverplates.

2.9.2.4 All completed systems shall be provided with a factory prime painted finish, suitable for field finish painting.

2.9.2.5 Wall ducts shall be equivalent to Square D Company "RWT" Series, as a standard of construction and quality.

2.9.3 TRENCH DUCTS

2.9.3.1 Trench duct is to be installed flush with finished concrete floor slab with a vertical tolerance to adjacent surfaces of 1/16" plus or minus. Nominal depth of trench duct shall be adjustable from 2 3/8" to 3 ½ ", minimum 12" width unless otherwise noted on plans.

2.9.3.2 Trench duct shall be constructed of code-gauge steel, 14 gauge minimum, with corrosion resistant finish. Surfaces of duct or fittings in contact with concrete shall be painted with two coats of "Asphaltum" or receive equivalent coating or taping prior to placement of concrete.

2.9.3.3 Furnish trench duct with flat turns, riser transition fittings to wall duct or panelboard as shown, concrete tight couplings, internal barriers as required to separate services, reducers, end closers, tees and all other fittings as indicated or required.

2.9.3.4 Furnish coverplates of aluminum, ¼ " thickness minimum, with flush fasteners in nominal 24" lengths. Furnish grommeted openings or nipples with insulated bushings as required. Coverplates shall not deflect more than .085" with application of a 200 pound concentrated load. Any compartment over 16" in width shall have additional coverplate support, to meet the deflection criteria above.

2.9.3.5 Provide (as standard) an aluminum tile trim flange (verify and coordinate with floor finishes). Refer to architectural drawings, where applicable.

2.9.3.6 Trench duct and coverplates shall be equivalent to Square "D" Company RSV/RCP-AL series, as a standard of quality and construction.

2.10 CABLE TRAY OR CABLE TROUGH

2.10.1 Cable tray shall be furnished in all-aluminum construction or galvanized steel construction, as noted and sized on the drawings.

2.10.2 Galvanized finishes on tray shall be hot-dipped after fabrication for all tray in exterior locations. Mill finished galvanizing may be used where tray is installed indoors in dry locations.

2.10.3 The installing contractor shall carefully follow the manufacturer's recommendations for hanger sizing and hanger support spacing. The weight per linear foot of tray, fully loaded with a 200% safety factor shall be accounted for in sizing hangers. Refer to manufacturer's instructions and/or the drawings, as applicable for hangers and supports. In no case shall supports be spaced further than 8'-0" apart.

2.10.4 Cable tray shall be of the ladder type with rungs spaces 12" apart. Side rails shall be of I-Beam or C-Channel construction with welded rungs, depth and width as indicated on the drawings.

2.10.5 Cable trough shall be similar to cable tray, except bottom shall be a ribbed solid piece, depth and width as indicated on the drawings.

2.10.6 Cable tray or trough shall be provided with all required fittings for a complete installation. Fittings shall include, but not be limited to: Horizontal and vertical elbows and tees, smooth dropout fittings, end closure plates, fixed (or adjustable) splices as needed for field offsets, reducers, barriers or box connector flanges.

2.10.7 Cable tray and trough shall be equivalent to Square "D" Company Series CLA/CLG (ladder tray) or CTA/CTG (trough) as a standard of quality and construction.

2.11 DUCT BANKS

2.11.1 Duct banks are defined as a raceway or raceways installed in underground locations, enclosed in a steel-reinforced concrete envelope. They shall be installed where indicated on the drawings or otherwise required.

2.11.2 All concrete used in duct bank construction shall be 3000 PSI minimum 28 day compressive strength unless otherwise noted, in accord with latest A.C.I. standards. Testing of concrete shall be the responsibility of the Contractor, as directed by the engineer. Place concrete against undisturbed earth, or provide forming as needed.

2.11.3 Duct bank raceways shall receive a minimum of 3" concrete cover all sides. Minimum size of any duct bank shall be 12" x 12" square, in cross section. In all cases, local and national codes shall apply to duct bank construction where they exceed the requirements of this specification.

2.11.4 Each corner of duct bank shall receive a minimum No. 4 steel reinforcing bar with 2" minimum concrete cover on all sides. Lap bars fifteen diameters at all splices. Reinforcing steel shall be rigidly supported during pour and vibration, and shall be constructed to ASTM standards.

2.11.5 Support for encased raceways shall be as recommended by raceway manufacturer, spaced 8'-0" maximum on centers, rigidly fastened to prevent floating of ducts during concrete pours. Supports shall be of a material compatible with the raceway, and shall be of the interlocking type, forming a rigidly braced installation. Provide base type and intermediate type spacers to suit conduit configurations and sizes.

2.11.6 Where rigid nonmetallic raceways leave concrete duct banks, a transition to rigid steel conduit shall be made 18" inside the concrete envelope. Under no circumstances shall PVC, EB or similar ducts exit concrete envelope, except where duct bank ties into a manhole wall. Provide bell ends at such terminations

and towel duct bank rebars 4" into manhole wall with grout. Refer to details on drawings, as applicable. Slope all raceways within duct bank systems such that they shall drain into manholes or pull boxes. Provide proper drainage at manholes or pull boxes to prevent water accumulation.

2.11.7 Where ducts transition thru manholes, pull boxes or at terminating end, each duct shall be specifically identified. A nomenclature as shown on the drawings or as agreed upon by the installer and engineer shall be utilized to identify each individual duct. A permanent means of identifying each duct, such as engraved lamacoid plates or stamped metal tags shall be used.

2.12 RACEWAY FITTINGS

2.12.1 Raceway fittings (or condulets) shall be of gray iron, malleable iron or heavy copper-free cast aluminum. They shall be furnished in proper configurations, avoiding excessive plugged openings. Any openings that are left shall be properly plugged. All coverplates shall be gasketed with neoprene or similar approved materials, rated for the environment.

2.12.2 Where required, raceway fittings shall be provided in explosion-proof configurations rated for the atmosphere. Place conduit seal off fittings at each device in accord with applicable codes. Seal off fittings shall be packed with wadding, and poured with an approved non-shrink sealing compound.

2.12.3 Where conduit transitions in a run from a cold to a warm environment, (such as at a freezer, refrigerator or exterior wall) sealoff fittings shall be placed on the warm side immediately at the boundary to prevent migration of condensation within raceway systems.

2.12.4 Expansion fittings shall be provided at all locations where conduits or other raceways cross over expansion joints. Provide copper ground bonding jumpers across expansion fittings.

2.12.5 Conduit bodies, junction boxes and fittings shall be dust tight and threaded for dusty areas, weatherproof for exterior locations and vapor tight for damp areas. Conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equivalent. All surface mounted conduit fittings as with "FS", "FD", "GUB" Types etc., shall be provided with mounting hubs.

2.12.6 Where lighting fixtures, appliances or wiring devices are to be suspended from ceiling outlet boxes, they shall be provided with ¾ " rigid conduit pendants. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and No. 14 gauge steel locking ring. Provide safety chain between building structure and ballast housing of light fixtures for all fixtures, appliances or devices greater than 10 lbs weight. Fixtures shall be installed plumb and level.

2.12.7 Fittings for threaded raceways shall be tapered thread with all burrs removed, reamed ends and cutting oil wiped clean.

2.12.8 Fittings for E.M.T. conduit shall be of the set-screw type. Fittings for sizes 2" and larger shall have two setscrews each side. Conduit stops shall be formed in center of couplings. All EMT connectors and couplings shall be of formed steel construction.

2.12.9 Indentation or die-cast fittings shall not be permitted in any raceway system.

2.12.10 Compression type fittings shall be utilized for EMT conduit installed in damp or dusty locations, or where otherwise indicated.

2.12.11 All conduit fittings shall be securely tightened. All threaded fittings shall engage seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.

2.13 SUPPORTS AND HANGERS

2.13.1 Supports and hangers shall be installed in accord with all applicable codes and standards. They shall be corrosion - resistant, galvanized or furnished with an equivalent protective coating. All electrical raceways shall be hung independently from the building structure with U.L. listed and approved materials. Hangers and supports depending from the support systems of other trades work shall not be permitted, except with specific approval in writing from the Engineer. The use of tie wire for support or fastening of any raceway system is prohibited. Perforated metal tape shall not be used for raceway support.

2.13.2 No raceway shall be installed on acoustic tile ceiling tees, or in any location that will impair the functioning, access or code-required clearances for any equipment or system.

2.13.3 Supports for raceways shall be of materials compatible with the raceway, of malleable iron, spring steel, stamped steel or other approved material. Die-cast fittings are not permitted for supports.

2.13.4 The installing contractor shall provide all necessary supports and braces for raceways, in a rigid and safe installation, complying with all applicable codes.

2.13.5 Individual conduits run on building walls or equipment shall be secured by one hole galvanized malleable iron or stamped steel pipe strap or "minerallac" 2-piece straps. The straps are to be anchored by an approved means such as expansion anchors, toggle bolts, through bolts, etc. Where required by codes or other standards, provide spacers behind mounting clamps to space conduits off walls.

2.13.6 Individual conduits run on building steel shall be secured by means of clamp supports similar and equal to those manufactured by the C.C. Korn Company, Elcen Co., B-Line or approved equivalent. Provide korn clamps, bulb tee clamps, flange clamps, beam clamps, "minerallacs", etc.

2.13.7 Where feasible, vertical and/or horizontal runs of conduit shall be grouped in common hangers on "trapezes" of channel stock as manufactured by "Unistrut" or equivalent, 1-5/8" minimum depth. Utilize conduit clamps appropriate to the channel.

2.13.8 Channel strut systems for supporting electrical equipment or raceways shall be constructed of 16 gauge minimum hot dip galvanized steel with 9/16" diameter holes on 8" centers, with finish coat of paint as manufactured by Unistrut, B-Line, Kindorf, or approved equivalent.

2.13.9 The minimum diameter of round all-thread steel rods used for hangers and supports shall be ¼ ", 20 threads per inch. All-thread rod shall be furnished with a corrosion-resistant finish.

2.13.10 Welding directly on conduit or fittings is not permitted.

2.13.11 Provide riser support clamps for vertical conduit runs. Riser support clamps shall be of heavy gauge steel construction. Install riser support clamps at each floor level penetration, or as otherwise required.

2.13.12 Provide conduit cable support clamps for vertical conductor runs as required or indicated on plans. Clamps to be insulating wedging plug, with malleable iron support ring. Install within properly sized and anchored junction box.

2.13.13 Spring steel clips and fittings such as those manufactured by HITT-Thomas, Caddy-Erico, or approved equivalent, with black oxide finish are permitted in any indoor dry location for concealed work, where acceptable to the local authority having jurisdiction.

2.14 FIRESTOPPING MATERIALS

2.14.1 All conduits, and cables penetrating fire rated floors and walls must be firestopped. firestopping assembly must be UL listed. All corridor walls, storage room walls and mechanical room walls are to be considered on hour fire rated. The second floor slab shall also be considered one hour rated.

2.14.2 Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type. (i.e., one hour fire rated gypsum wall board with insulated metal pipe penetration.)

2.14.3 3M fire protection products are listed below. Equivalent products may be submitted if they are UL listed.

2.14.4 The manufacturer of the firestopping materials must provide on site training for the contractor. The training session shall demonstrate to the contractors the proper installation techniques for all the firestopping materials. The training session shall be four hours minimum. Contact the Engineer prior to conducting this training session.

2.14.5 Firestopping materials to include but not limited to the following:

2.14.5.1 3M fire barrier FS-195 wrap/strip.

2.14.5.2 3M fire barrier CP 25 caulk.

2.14.5.3 3M fire barrier MP moldable putty.

2.14.5.4 3M fire barrier RC-1 restricting collar with steel hose clamp.

2.14.5.5 3M fire barrier damming materials.

2.14.5.6 3M fire barrier CS-195 composite sheet.

2.14.5.7 3M fire barrier fire dam 150 caulk.

2.14.5.8 Steel sleeves.

PART 3 – INSTALLATION:

3.1 This Contractor shall lay out and install all conduit systems so as to avoid any other service or systems, the proximity of which may prove injurious to the conduit, or conductors which it confines. All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above ceilings. Size of all conduit shall conform to Table No. 1, Chapter 9, of the National Electrical Code, unless otherwise shown on the Contract Drawings.

3.2 No conduit shall be installed in or below poured concrete slabs except with permission of the architect or engineer. Conduit shall be held at least 6" from flues or hot water pipes.

3.3 All exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. All conduit shall have supports spaced not more than eight feet apart.

3.4 Conduit shall be installed in such a manner so as to insure against collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps. Trapped conduit runs shall be provided with

explosion proof drains at low points. Runs of conduit between junctions shall not have more than the equivalent of three 90º bends.

3.5 Junction boxes shall be installed so that conduit runs will not exceed 85', or as shown on the Contract Drawings.

3.6 Underground electric, cable TV, telephone service or other rigid steel conduit and underfloor rigid steel conduit below the concrete floor slab shall be painted with two coats of bitumastic paint, such as "Asphaltum".

3.7 All underground or underfloor conduits shall be swabbed free of all moisture and debris before conductors are pulled.

3.8 At least one 1 inch and three ¾ inch conduits shall be stubbed from flush-mounted panelboards into the nearest accessible area for future use. Provide suitable closures for these stubs. Identify each stub with a suitable hang tag.

3.9 Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the N.E.C., and NECA "Standard of Installation", complying with recognized industry practices.

3.10 Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.

3.11 Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure wherever possible, to maximize available space and not restrict other trades.

3.12 Complete installation of electrical raceways before starting installation of cables or wires within raceways.

3.13 All underground conduits shall be buried to minimum depth of 24" from the top of the concrete encasement or raceway to finished grade, unless otherwise noted on plans. Observe minimum burial requirements of local utility company where their standards or regulations apply. Conduits containing primary power conductors, (higher than 600 volts to ground) shall be 42" to top below finished grade, unless otherwise noted on plans.

PART 4 – SPECIALTIES:

4.1 All EMT terminations at junction boxes, panels, etc. shall be made with case hardened locknuts and appropriate fittings, with insulated throat liners. Insulating terminations shall be manufactured as a single unit. The use of split sleeve insulators is not permitted.

4.2 All rigid conduit, except main and branch feeders, shall have heavy fiber insulating bushings reinforced with double locknuts. All branch and main feeders shall have insulated bushings with grounding lugs and shall be bonded to enclosures with appropriately sized copper jumpers, except at pad mounted transformers. Bonding jumpers shall be installed as required by the N.E.C. and other applicable codes.

4.3 All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equivalent to Thomas and Betts, Ideal, Appleton, Efcor, or approved equivalent, rated for the environment.

4.4 All pulling lines left in open conduit systems shall be non-metallic, left securely tied off at each end.

4.5 Where spare raceways terminate in switchboards or motor control centers a fishtape barrier shall be provided.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260544 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

PART 1 – GENERAL:

1.1 Each Electrical Contractor's attention is directed to Section 260500, General Provisions, Electrical and all other contract documents as they may apply to his work.

1.2 Each Electrical Contractor shall include all excavating, filling, grading and related items required to complete his work as shown on the drawings and specified herein.

1.3 Electrical distribution lines and underground telephone or TV cables shall, in no case, be placed in the same trench with sanitary, storm, domestic or fire protection water lines. Phone cable may, at the Contractor's option, and if acceptable to both utility companies, be placed in a common trench with power lines as long as 8" of earth separation is maintained. T.V. cable shall, in all cases, be placed in a separate trench with two feet separation from electrical power lines.

1.4 Depths of bury shall be as indicated on the drawings.

PART 2 - SUBSURFACE DATA:

2.1 Subsurface investigations have been made and the results shown on the drawings. The information was obtained primarily for use in preparing foundation design. Each Electrical Contractor may draw his own conclusions therefrom. No responsibility is assumed by the Owner for subsoil quality or conditions other than at the locations and at the time investigations were made. No claim for extra compensation, or for extension of time, will be allowed on account of subsurface conditions inconsistent with the data shown.

2.2 Materials to be excavated shall be unclassified, and shall include earth, rock, or any other material encountered in the excavation to the depth and extent indicated on the drawings and specified herein. No adjustment in the Contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating.

PART 3 - BENCH MARKS AND MONUMENTS:

3.1 Maintain carefully all bench marks, monuments and other referenced points. If disturbed or destroyed, replace as directed.

PART 4 – EXCAVATION:

4.1 Each Electrical Contractor shall accept the site as he finds it and remove all trash, rubbish and material from the site prior to starting excavation for his work.

4.2 Excavate trenches to sufficient width and depth for proper installation of the work and where required, smooth the bottom on the trench with hand tools.

4.3 The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Architect. Any damage to existing structures, exterior services or rock intended for bearing, shall be corrected at the responsible Contractor's expense.

4.4 Keep trenches free from water while construction therein is in progress. Under no circumstances lay conduit or cable in water. Pumping or bailing water from this Contractor's trenches, which is required during construction shall be accomplished at his expense.

4.5 In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, etc. Each Contractor shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage, or any other damage incurred in the course of excavation, shall be borne by the responsible Contractor.

PART 5 – BACKFILL:

5.1 Backfill shall be accomplished with clean debris free earth and the new earth tamped at 12" intervals so as to avoid earth sinks along the trench. The responsible Contractor will be required to return to the project and fill any sunken areas along the route of his work.

5.2 Backfill trenches only after conduit and cable have been inspected, tested, and locations of pipe lines have been recorded on "as-built" drawings.

5.3 The backfill below paved areas shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill.

5.4 The backfill below sodded or seeded areas shall be brought to within six inches of finished grade. The remaining six inches shall be backfilled with clean soil.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260553 – IDENTIFICATIONS

PART 1 – GENERAL:

1.1 Equipment, disconnect switches, motor starters, pushbutton stations, special device plates, and similar materials shall be clearly marked as to their function and use. Markings shall be applied neatly and conspicuously to the front of each item of equipment with ½ " black lamacoid plate (or equivalent) with white letters ¼ " high.

1.2 The Contractor shall provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc. controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic card holders in each panel.

1.3 Branch circuit panelboards and switch gear shall be provided with a black lamacoid plastic plate with ½ " white letters for panel designation and ¼ " white letters showing voltage and feeder information. Branch circuit switches shall be designated as to function. Panelboard and switchgear labels shall indicate the source they are fed from, and the circuit number at that source. Clearly indicate the exact label legend to be furnished with each panelboard and switchgear on the shop drawings for each item of equipment prior to submission of shop drawings.

1.4 Where branch circuit panelboards and switchgear are connected to an emergency source, the lamacoid plate shall be red, and the word "emergency" shall be incorporated into the legend. In health care applications, the NEC - designated branch (life safety, critical or equipment branch) shall also be incorporated into the legend, all in ¼" letters. Also provide similar plates and legends for automatic transfer switches, as appropriate.

1.5 Lamacoid plates shall be located at center of top of trim for branch circuit panels, switch gear, and centered at side for branch circuit switches. Fasten with self-tapping stainless steel screws or other approved method.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 262400 - ELECTRICAL DISTRIBUTION EQUIPMENT

PART 2 - DISTRIBUTION PANELBOARDS (600 AMPERE OR GREATER):

2.1 Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel, with gray baked enamel finish electrodeposited over cleaned, phosphatized steel.

2.2 The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers. Bus structure shall be full height of panel.

2.3 Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50NC. rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All panelboards unless otherwise noted shall have space to accept forty-two 20 amp one pole circuit breakers.

2.4 Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF." Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. All panelboards shall be capable of accepting 225 amp 3 pole branch breakers as a minimum unless otherwise noted.

2.5 Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on schedules on the plans or as determined by verification with local utility company. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

2.6 Distribution panelboards shall be Square "D", G.E., I.T.E./Siemens or approved equivalent.

PART 3 - BRANCH PANELBOARDS:

3.1 This section covers lighting and power panelboards (refer to schedules, notes on Drawings and the Electrical One-Line Diagram, of the Contract Drawings).

3.2 All panelboards shall be of the circuit breaker type, and shall be of one manufacturer.

3.3 Branch panelboards shall be as indicated on the drawings and as specified herein. The lighting panelboards shall be of the dead-front, quick-make, quick-break, bolt-in circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Locks shall all be keyed alike. Each door shall have a directory card inside, covered with a plastic shield, filled in with black india ink or typewritten with circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner -- not numbers on Contract Documents.

3.4 Special Note: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.

3.5 Branch panelboards shall be surface or flush mounted as indicated on the Contract Drawings.

3.6 Circuit breakers for 120/208 volt systems shall be of 10,000 A.I.C. RMS symmetrical rating unless otherwise indicated on the Contract Drawings. For 277/480 volt systems, provide circuit breakers with 14,000 A.I.C. ratings unless otherwise indicated.

3.7 All main bus and connections thereto in branch panelboards shall be copper. All bus bars shall extend full length of panelboards. Provide separate neutral and ground bars.

3.8 All circuit breakers used to switch lights shall be SWD (switching duty) rated.

3.9 Panels shall be Square "D", G.E., I.T.E./Siemens or approved equivalent.

PART 4 - INSTALLATION INSTRUCTIONS:

4.1 Panelboards with circuit breakers installed before the building has been finished and cleaned shall be masked.

4.2 All dust and debris shall be removed from the panels before they are energized and placed in service.

4.3 All panelboard fronts shall be omitted until final punch list inspection is made. Directories for each panelboard shall be completed and available for review by the Engineer at that time.

PART 5 - SAFETY SWITCHES:

5.1 Provide heavy duty safety switches as a final disconnecting means as required by NEC and/or as indicated on the Contract Drawings.

5.2 All safety switches shall be NEMA Type 1, NEMA 3R, or as required by the operating environment, Heavy Duty Type HD, UL listed.

5.3 All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.

5.4 All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.

5.5 Switch mechanism shall be quick-make, quick-break, load break rated, 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 and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to

three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

5.6 Switches shall be as manufactured by Square D., G.E., I.T.E./Siemens or approved equivalent.

PART 6 – FUSES:

6.1 Upon completion of the building, the Contractor shall provide the owner with spare fuses as shown below. All fuses shall be Bussmann, Shawmut, Gould or Reliance.

6.1.1 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares:

6.1.2 Bussmann spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

6.2 No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to insure retention of selective coordination, as designed.

6.3 Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN HI-CAP TIME DELAY FUSES KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the fuse barrel. Fuses shall be a time-delay type and must hold 500% of rated current for a minimum of 5 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes R.M.S. symmetrical. The fuses shall be UL Class L.

6.4 Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts). All dual element fuses shall have separate overload and short circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284NF melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of l0 seconds and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1.

6.5 Motor Circuits - All individual motor circuits rated 480 amperes or less shall be protected by BUSSMANN LOW PEAK DUAL-ELEMENT FUSES LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in rating approximately l25% of motor full load current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the Type KRP-C HI-CAP Time Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN RK (250 volts) or LPS-RK (600 volts) installed in rating approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.

6.6 Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual Element fuses LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

PART 7 - DISTRIBUTION TRANSFORMERS:

7.1 The Contractor shall provide dry-type transformers as manufactured by Square "D", G.E., Siemens or equivalent. KVA ratings shall be as indicated on the electrical plans.

7.2 Three phase transformers are to have 480 volt Delta primary and 120/208V/30/4W secondary. 30 KVA transformers and larger are to be supplied with 2-2½% full capacity taps above and 4-2½% full capacity taps below primary voltage. Exceptions to the above will be shown on the electrical plans.

7.3 Transformers 30 KVA and above shall be Class H, 115°C. and shall have the ability to carry a continuous 15% overload without exceeding a 115°C rise above 40° ambient.

7.4 Transformer coils shall be vacuum impregnated with non-hygroscopic, thermosetting varnish. Each layer shall have end fillers or tie downs to provide maximum mechanical strength. Insulation systems and their construction techniques shall be listed by Underwriters Laboratories.

7.5 Transformer coils shall have a final wrap of electrical insulating material designed to prevent injury to the coil wire. Transformers having coils with magnet wire visible will not be acceptable.

7.6 All cores to be manufactured from a high grade, non-aging, silicon steel with high magnetic permeabilities, low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below saturation to allow for a minimum of 10% over voltage excitation. The cores shall be clamped with structural angles (formed angles not acceptable) and bolted to the enclosure to prevent damage during shipment or rough handling.

7.7 The core and coil unit shall be completely isolated from the enclosure by means of a vibration isolating system and shall be so designed as to provide for continual securement of the core and coil unit to the enclosure. Sound isolating systems requiring the removal of all tie down facilities will not be acceptable.

7.8 Transformers 15 KVA thru 45 KVA shall be provided with interchangeable mounting for floor or wall.

7.9 The maximum top of case temperature shall not exceed 35°C above ambient.

7.10 The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with baked enamel.

7.11 The core and coils shall be visibly grounded to the frame of the transformer cubicle by means of a flexible grounding strap of adequate size.

7.12 Sound levels shall be guaranteed by the manufacturer and substantiated by certified tests on each unit furnished. The sound levels are not to exceed the following values: 10 to 45 KVA, 42 D.B. to 150 KVA; 45 D.B., 225 to 300 KVA; 50 D.B. and 500 KVA, 54 D.B.

PART 8 – CONTACTORS:

8.1 General

8.1.1 Contactors shall be continuously rated at the specified amperes per pole for all types of ballast and tungsten lighting, resistance and motor load. Contactors shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts will not be acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring. Contactors shall have straight-through wiring with all terminals clearly marked. Contactors shall have a gasketed NEMA Type 1 (NEMA 12 for electrically-held) enclosure, unless otherwise noted or required.

8.1.2 Contactors shall be approved per UL 508 and/or CSA, and be designed in accordance with NEMA Standards. They shall be industrial-duty rated for applications to 600 volts maximum. I.E.C.-style contactors are not acceptable.

8.1.3 Contactors shall have provisions for factory or field addition of:

8.1.3.1 Four N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.

8.1.3.2 Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.

8.1.3.3 Control-circuit fuse holder, one or two fuses.

8.1.3.4 0.2-60 second adjustable interval timer attachment, if so indicated on plans.

8.1.3.5 Transient-suppression module for coil control circuit. Coil control to be 120 volts. Provide circuit or step-down transformer.

8.2 Electrically Held Lighting Contactors

8.2.1 Contactor coils shall be continuously rated and encapsulated, 120 volt rated. Enclosures shall be NEMA 12, to minimize noise transmission.

8.3 Mechanically Held Lighting Contactors

8.3.1 Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. Coils shall be rated for 120 volt operation.

8.3.2 Lighting contactors shall be Square D Class 8903 or equivalent by G.E., I.T.E./Siemens, or Allen-Bradley.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 262726 - WIRING DEVICES AND PLATES

PART 1 – GENERAL:

1.1 This section of the specifications includes wiring devices, cover plates, weatherproof and dust-tight closures, communications devices and floor outlets.

1.2 Wiring devices are listed by manufacturer and catalog numbers to establish the quality and type required. Equivalent devices of other manufacturers will be acceptable with prior approval of the Engineer. Submit cutsheets and/or samples of each type ten days prior to bid date for review and written approval to bid. Insofar as possible, standard application or special application devices shall be by one manufacturer.

PART 2 – MATERIALS:

TYPE	**RATING**	**CONFIGURATION**	**COLOR**	**VENDOR - CAT. #**
RECEPTACLE - DUPLEX **COMMERCIAL GRADE**	125V, 20A	NEMA 5-20R	*	HUBBELL CR5362 * GE 5362 * LEVITON 5362 *
	125V, 15A	NEMA 5-15R	*	HUBBELL CR5262 ** GE 5262 ** LEVITON 5262 **
	* USE WHEN ON DEDICATED 20A CKT., OR CALLED OUT ** USE WHEN ON DEDICATED 15A CKT., OR WHEN MORE THAN ONE RECEPTACLE ON A CIRCUIT			
RECEPTACLE - DUPLEX **PREMIUM GRADE**	125V, 20A	NEMA 5-20R	*	HUBBELL 5352 LEVITON 5362 GE 5362,
	125V, 15A	NEMA 5-15R	*	HUBBELL 5252 LEVITON 5262 GE 5262
	* USE WHERE ON DEDICATED 20A CKT., OR CALLED OUT ** USE WHERE ON DEDICATED 15A CKT., OR WHERE MORE THAN ONE RECEPTACLE ON A CIRCUIT			
RECEPTACLE - DUPLEX G.F.I.	125V, 20A	NEMA 5-20R	*	HUBBELL GF-5352 GE GF-5342 LEVITON 6898
RECEPTACLE - SIMPLEX	125V, 20A	NEMA 5-20R	*	HUBBELL 5361
RECEPTACLE - DUPLEX, SAFETY TYPE (WITH TAMPER-RESISTANT SCREWS)	125V, 15A	NEMA 5-15R	!	HUBBELL SG-62H - NO SUBSTITUTIONS
RECEPTACLE, DUPLEX NEON PILOT FACE-RED	125V, 15A	NEMA 5-15R	*	HUBBELL 5262-LHR GE 5362-LHR LEVITON 5362-LHR

RECEPTACLE, SIMPLEX WITH CLOCK HANGER TAB, STAINLESS STEEL PLATE	125V, 15A	NEMA 5-15R	METAL	HUBBELL 5235 LEVITON 658-BR ARROW-HART 5760
RECEPTACLE, DUPLEX ISOLATED GROUND (WITH ORANGE LEGEND PLATE)	125V, 20A	NEMA 5-20R	ORANGE	HUBBELL IG-5362 GE 5362-IG LEVITON 5362-IG
RECEPTACLE, DUPLEX HOSPITAL GRADE (TO BE USED IN ALL PATIENT CARE AREAS, PER N.E.C., ART. 517)	125V,20A	NEMA 5-15R NEMA 5-20R	*	HUBBELL 8200H GE 8200 LEVITON 8200 HUBBELL 8300H GE 8300 LEVITON 8300
RECEPTACLE, DUPLEX RED COLOR NYLON FACE (FOR EMERGENCY POWER OUTLETS, WITH RED PLATE)	125V, 20A	NEMA 5-20R	RED	HUBBELL 5352-RDB GE 5362-RDB LEVITON 5362-RDB
RECEPTACLE, DUPLEX ISOLATED GROUND WITH SURGE SUPPRESSION, INCLUDING INDICATOR LIGHT	125V, 15A	NEMA 5-15R	BLUE DEVICE OR BLUE COVER PLATE	HUBBELL 5250S LEVITON 5380 ARROW-HART 5362
RECEPTACLE, SINGLE	250V, 20A	NEMA 10-20R	BLACK	HUBBELL 6810 GE 4124 LEVITON 5032
RECEPTACLE, SINGLE	250V, 30A	NEMA 6-30R	BLACK	HUBBELL 9330 GE 4139 LEVITON 5372
RECEPTACLE, SINGLE	250V, 50A	NEMA 6-50R	BLACK	HUBBELL 9367 GE 4141 LEVITON 5374
SWITCH, SINGLE POLE	120/277V, 20A	SPST	*	HUBBELL 1221 GE 5951 LEVITON 1221
SWITCH, SINGLE POLE - RED TOGGLE (WITH RED COVER PLATE, FOR EMERGENCY LIGHTING CONTROL)	120/277V, 20A	SPST	RED	HUBBELL 1221-RDB GE 5951-RDB LEVITON 1221-RDB

SWITCH, THREE-WAY	120/277V, 20A	3-WAY	*	HUBBELL 1223 GE 5953 LEVITON 5953
SWITCH, FOUR-WAY	120/277V, 20A	4-WAY	*	HUBBELL 1224 GE 5954 LEVITON 5954
SWITCH, KEYED	120/277V, 20A	SPST	N/A	HUBBELL 1221-L GE 5951-L LEVITON 1221-L
SWITCH, KEYED	120/277V, 20A	3-WAY	N/A	HUBBELL 1223-L GE 5953-L LEVITON 1223-L
SWITCH, KEYED	120/277V, 20A	4-WAY	N/A	HUBBELL 1224-L GE 5954-L LEVITON 1224-L
NOTE: SWITCH, KEYED TO EACH BE FURNISHED WITH ONE HUBBELL #1209 KEY. TURN OVER TO OWNER AT CLOSE OF PROJECT AND OBTAIN RECEIPT FOR VERIFICATION THAT KEYS HAVE BEEN DELIVERED.				
SWITCH, MOMENTARY, 3-POSITION, CENTER OFF SWITCH, PILOT (TOGGLE LIT IN OFF POSITION)	120/277V, 20A (VERIFY VOLTAGE USED)	SPDT	*	HUBBELL 1221 GE EQUIVALENT LEVITON EQUIVALENT
SWITCH, PILOT (TOGGLE LIT IN OFF POSITION)	120/277V, 20A (VERIFY VOLTAGE USED)	SPDT OR AS NOTED	CLEAR "LEXAN"	HUBBELL 1221 GE EQUIVALENT LEVITON EQUIVALENT
SWITCH, PILOT (TOGGLE LIT IN ON POSITION)	120/277V, 20A (VERIFY VOLTAGE USED)	SPST OR AS NOTED	CLEAR "LEXAN"	HUBBELL 1221-PL7 GE EQUIVALENT LEVITON EQUIVALENT
TIMER SWITCH	120V	SPST, 15 MINUTE	*	NUTONE VS63 GE EQUIVALENT LEVITON EQUIVALENT

NOTES:

1. PROVIDE MATCHING CAP (PLUG) FOR ALL RECEPTACLES 30 AMP RATED AND ABOVE AS REQUIRED FOR EQUIPMENT

2. ALL RECEPTACLES SHALL BE BACK OR SIDE-WIRED, CLAMPING TYPE

* SEE ARTICLE 3, COLOR.

2.2 Small Motor Control Switches:

2.2.1 For small line-to-neutral motor loads of 3/4 HP or less, single phase, rated at 120 or 277 volts, provide snap-type, H.P. rated motor starter switch without thermal overloads. Provide with NEMA 1, NEMA 3R or other enclosure suitable for the location and atmosphere. All manual starters in finished areas shall be in flush-mounted enclosures. If the motor to be controlled is not equipped with internal thermal overload protection, overload heaters sized to match the motor nameplate amperes and the ambient temperature shall be provided.

PART 3 – COLOR:

3.1 Color of devices shall be as selected by the architect. Samples (devices, plates or both) may be required to be submitted with other architectural color items by the Contractor. The Contractor shall coordinate any such submission required with other trades, the Prime Contractor or as needed.

3.2 Where devices are controlling or supplying emergency power from a standby source, the device color shall be red, as with switch toggles or receptacle fronts. Plate color shall match others on normal power in the building unless otherwise noted.

PART 4 - MANUAL DIMMERS:

4.1 Manual dimmers for incandescent, MR-lamp incandescent or fluorescent loads shall be matched to the type load intended to be controlled.

4.2 Power rating shall be verified by examining the plans and suitable for the load, but in no case less than circuit load. Furnish dimmers in nominal power ranges of 600W, 1000W and 1500 watts.

4.3 Manual dimmers shall be provided with all solid state components, complete with choke coil and/or other R.F.I. suppression devices.

4.4 Manual dimmers shall be suitable for mounting in single gang outlet box, ganging together in multi-section boxes where indicated, without derating being necessary.

4.5 Manual dimmers shall be the tap-on, tap-off, rotary type, with full range control 0-100%. Hunt Company or equivalent by G.E., Leviton, Hubbell or Lutron.

OR

4.6 Manual dimmers shall be of the sliding-type, with detent stop at off position, full range control 0-100%. Lutron Company "Nova" Series or equivalent Lithonia, Lightolier.

4.7 Manual dimmers for fluorescent lighting or low voltage transformer-fed incandescent fixtures shall be matched to suit the characteristics of the particular manufacturer's electronic ballast or transformer used in the dimming - type fixture. Submit shop drawings of dimmer in the same submittal as the lighting fixtures.

PART 5 - PLATES AND COVERS:

5.1 Unless otherwise specified or noted, all wiring device plates and covers shall be smooth thermoplastic, Hubbell "P" Series or equivalent G.E. or Leviton. Color shall match device unless otherwise indicated.

5.2 All kitchen, gymnasium or food service area plates shall be bright finish 302 stainless steel.

5.3 Cover plates shall be of one manufacture insofar as possible.

5.4 Weatherproof plates for G.F.C.I. receptacles shall be cast aluminum, self-closing, gasketed, suitable for standard box mounting, U.L. listed for wet location use, cover closed. Vertical mounting - Hubbell WP26, horizontal mounting - Hubbell CWP26H (die-cast zinc) or equivalent Leviton or G.E.

5.5 Weatherproof switch plates for toggle-handle switches shall be clear silicone rubber, for standard outlet boxes. Hubbell 1795 or equivalent G.E. or Leviton.

5.6 Cover plates for computer, telephone or other system outlets shall be as required to meet supplier or the owner's requirements, as applicable. Color to match other plates on project. Furnish telephone plates with wall-mounting studs if mounted at 48" or higher. See devices schedule below.

PART 6 - COMMUNICATIONS DEVICES AND PLATES:

6.1 Communications devices and wallplates furnished for this project shall all be standard products, of the same manufacturer. They shall consist of a wallplate bezel, capable of holding snap-in devices as indicated.

6.2 Color of communications wallplates shall match the color of all other plates furnished on the project, matching switch, receptacles, etc. Verify all color selections with the Architect.

6.3 The color of communications wallplate snap-in inserts shall be as noted herein, or shall be per the owner's standards, if applicable. Verify color requirements prior to ordering any materials.

6.4 Provide securely-fastened permanent labels in the faceplate of communications wallplates that clearly and legibly indicate the address or unique identifier for an individual jack.

6.5 All communications wallplates shall be provided with a bezel capable of holding a minimum of four separate device inserts, unless otherwise noted. Provide blank inserts to close any unused positions, of a color to match the plate.

6.6 Communications wallplates and devices shall be as manufactured by Panduit, Lucent Technologies, Leviton, AMP or approved equivalent.

6.7

DEVICE INSERT SCHEDULE	
Multimode Fiber Optic (Always Install in Pairs)	FDDI - Compatible 62.5/125:, ST-Style Grey Color, Female (2 fibers terminated)
Ethernet Network Data	Category 5, 8 Pos/4 Pair Tan or Beige Color RJ-45, EIA/TIA 568A (4 pairs terminated)
Voice Circuits 4 Pair	Category 5, 8 Pos/4 Pair Black Color RJ-45, EIA/TIA 568A (4 pairs terminated)
Voice Circuits 4 Pair	Category 3, 8 Pos/4 Wire Black Color RJ-45, EIA/TIA 568A (4 pairs terminated)
Voice Circuits 2 Pair	Category 3, 4 Pos/2 Pair Green Color RJ-11 (2 Pairs Terminated)
Video Circuits	"F" Connector Bulkhead Style White Color (RG-6 coax termination)
Blank Cover	Color to Match Wallplate
Wallplate (4-Port/1 Gang)	Color to Match Wiring Devices Used in Adjacent Areas
Special Comm. Port for T-1 and Special Communication Circuits	Orange Color RJ-31X, 8 Pos/4 Pairs Terminated

PART 7 - STANDARD SINGLE-SERVICE FLOOR BOXES:

7.1 In general, floor boxes to be used flush in concrete floors shall be of single-gang stamped steel construction, round, deep style, fully adjustable Hubbell B-2537 Series, Type 1 or equivalent.

7.2 Where multiple gangs are indicated on the plans (or elsewhere), multi-gang (up to 3 yokes maximum) stamped steel, rectangular, deep style units shall be used. They shall be fully adjustable, Hubbell B-2437 Series, Type 1, or equivalent. Multiple-gang boxes shall be provided with removable partitions between each section in accord with N.E.C., where power and non-power circuits enter the same box.

7.3 In general, all cover plates for floor boxes shall be flush, solid brass. Provide typical plates as listed:

7.3.1	Duplex Outlet	-	Round, Duplex Flap - Hubbell S-3925 Rectangular, Duplex Flap - Hubbell S-3825
7.3.2	Telephone or Data		Round, Combination 1" or 2 1/8" - Hubbell S-2725 Rectangular, Combination 1" or 2 1/8" - Hubbell S-2625

7.4 Furnish floor boxes with threaded hubs as required to suit conduit routings, 3/4" minimum.

7.5 Furnish carpet flanges for all boxes installed in carpeted areas. Flanges to be clear polycarbonate plastic, round - Hubbell S-3079 or rectangular, for gangs indicated - Hubbell S-308 Series or equivalent.

7.6 Floor outlet boxes shall be installed dead level flush with wood, VCT, concrete or other hard surface type floor. Furnish special stop trims for terrazzo where required.

7.7 Outlets within floor boxes shall be as specified elsewhere in these specifications.

PART 8 - SPECIAL MULTI-SERVICE FLOOR BOXES:

8.1 In general, floor boxes that are to contain multiple services such as power, data, voice, video, etc., shall be constructed of stamped steel and heavy thermoplastic with barriers or compartments to separate power from signal services per National Electrical Code.

8.2 Provide multi-service floor boxes with proper trim for carpet, wood, terrazo, tile or concrete floors, wiring slots, dust covers and proper device plates to hold outlets, jacks, etc. They shall be fully adjustable. Conduit rough-in shall be as required. All tops shall be capable of receiving an insert of the surrounding floor material.

8.3 Outlets for multi-service floor boxes shall be as specified elsewhere in these specifications.

8.4 Set boxes dead level with flooring and provide proper support by thickening concrete slab, welding angle iron across joists below or other approved means.

8.5 Multi-service floor boxes shall be capable of containing a minimum of two duplex receptacles and two 4-position single gang modular plates for voice, video or data jacks and shall be as manufactured by Wiremold/Walker Co., "Resource RFB," with all required accessories or equivalent Hubbell or Lew.

PART 9 – INSTALLATION:

9.1 All wiring devices in dusty areas, exposed to weather and moisture shall be installed in Type "FS" or similar conduit fittings having mounting hubs, with appropriate cover plates.

9.2 Devices that have been installed before painting shall be masked. No plates or covers shall be installed until all finishing and cleaning has been completed.

9.3 Provide G.F.C.I. duplex feed-thru style receptacles where indicated or required by the National Electrical Code, whether specifically called out or not. When a G.F.C.I. receptacle is on a circuit with other non-G.F.C.I. receptacles, it shall always be placed at the homerun point of the circuit and shall be wired to ground-fault interrupt protect the downstream outlets on that circuit unless specifically indicated to the contrary. Provide a "G.F.C.I. protected" label on each downstream outlet.

9.4 Where surge suppression outlets are provided, they shall be ANSI Category "A" style. They shall be installed as dedicated-circuit outlets or where indicated with multiple outlets on a circuit, they shall be placed at the homerun point of that circuit and feed-thru wired to protect the downstream outlets on that circuit.

9.5 All receptacles shall be installed with ground prong at **top** position.

9.6 All outlets not provided with wiring devices shall be closed with a blank plate matching other plates in the area.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 262800 –ELECTRICAL SEISMIC RESTRAINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions, General Mechanical Provisions and Division 1 Specifications Sections, apply to this section.

1.2 MANUFACTURERS

1.2.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:

Mason Industries
Vibration Eliminator Co., Inc.
Vibration Isolation Co., Inc.

All Seismic restraint devices; isolators, calculations and seismic design shall be provided by a single vibration isolator manufacturer as listed above. All seismic design shall be prepared and stamped by a licensed Professional Engineer in the State of Indiana with a minimum of 5 years experience.

1.3 SUMMARY

1.3.1 This Section includes vibration isolators, vibration isolation bases, and seismic restraints and snubbers for mechanical and electrical equipment, duct and piping systems.

Drawings and calculation
Certification of seismic restraint designs
Installation supervision

1.4 PROJECT CONDITIONS

1.4.1 Building Classification Category: III

1.4.2 Building Importance Factor: 1.5

1.4.2.1 Building components with an Ip of 1.5 shall include, but not be limited to, Life Safety components and all components needed for continued operation of the facility. These components shall include but not be limited to fire alarm devices, normal and emergency panel feeds, etc.

1.4.3 Seismic Design: C

1.5 APPLICABLE CODES AND STANDARDS

1.5.1 The International Building Code; 2002.

1.6 SUBMITTALS

1.6.1 Product Data: Indicate types, styles, materials, and finishes for each type of isolator and seismic restraint specified. Include load deflection curves.

1.6.2 Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to the structure and to the supported equipment. Include auxiliary motor slides and rails, and base weights.

1.7 SEISMIC RESTRAINT SUBMITTALS

1.7.1 Shop Drawings: Show designs and calculations, prepared and stamped by a licensed professional engineer, as required for work of this project.

1.7.2 Design Calculations: Calculations for design and selection of seismic restraints for equipment, emergency generators, conduit systems, cabling systems, etc., stamped by a licensed professional engineer.

The following equipment shall be required to have calculations:

-Transformers
-UPS
-Light Fixtures
-Generators
-Large Equipment Enclosures

1.7.3 Analysis must include calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/ or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in listed building codes acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

1.7.4 Seismic Restraint Details: Detail fabrication and attachment of restraints and Snubbers.

1.7.5 Concrete Pad Details: Show required concrete pad size and location for equipment. Show locations of required pad anchors and stud wedge anchors.

1.7.6 Where wall, floors, slabs, or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for conduit, cable trays, cable rings, etc. must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.

1.8 SEISMIC RESTRAINT QUALITY ASSURANCE

1.8.1 Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who has a minimum of 5 years experience in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of vibration isolation bases and seismic restraints that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 SEISMIC CONTROLS

2.1.1 Thrust Restraints: Combination spring and elastomeric restraints with coil spring and elastomeric insert in compression. Factory set for thrust.

2.1.2 Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.

2.1.3 Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

2.1.4 Minimum Additional Travel: 50 percent of the required deflections at rated load.

2.1.5 Elastomeric Element: Molded, oil-resistant rubber or neoprene.

2.1.6 Finishes: Baked enamel for metal components. Color-code to indicate capacity range.

2.1.7 Seismic cable restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges.

2.1.8 Manufactured Seismic Snubbers: All-directional, double-acting snubbers

2.1.9 Construction: Interlocking steel members restrained by ¾-inch-(19-mm-) thick, replaceable, shock-absorbing neoprene insert. Maintain 1/8inch (3mm) clearance in all directions between rigid and resilient surfaces.

2.1.10 Fabricated Seismic Snubbers: Welded structural-steel designed and fabricated to restrain equipment or vibration isolation bases from excessive movement during a seismic event. Design to resist gravity forces identified by authorities having jurisdiction.

2.1.11 Construction: Welded steel shapes conforming to ASTM A 36 (ASTM A 36M)

2.1.12 Resilient Components: ¾ inch-(19-mm-) thick, replaceable, shock-absorbing neoprene insert.

2.1.13 Flexible Stainless Steel Hose: Hoses shall be installed on equipment side of shut-off valves horizontally and parallel to the equipment shafts wherever possible.

2.1.13.1 Construction: Stainless steel braid and carbon steel fittings.

2.1.13.2 Connection: Less than 3": Male nipples.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Install and anchor seismic-control products according to manufacturer's written instructions and authorities having jurisdiction.

3.1.2 Anchor interior mounts, isolators, hangers, and snubbers to vibration isolation bases. Bolt isolator baseplates to structural floors as required by authorities having jurisdiction.

3.1.3 Filled concrete inertia bases, after installing base frame, with 3000-psig (20.7-Mpa) concrete, and trowel to a smooth, hard finish. Cast-in-place concrete is specified in open parts of the specifications.

3.1.4 Isolated conduit, cable trays, etc. as follows (All are required to be braced):

3.1.4.1 Horizontal isolation: The first three hangers in the main lines near the mechanical equipment shall be precompressed spring and neoprene type. Floor supported piping shall rest on spring type isolators. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" deflection for pipe sizes up to and including 3",1 ½" deflection for pipe sizes up to and including 6", and 2 ½" deflection thereafter.

3.1.4.2 Riser isolation: Risers shall be suspended from spring and neoprene hangers or supported by floor spring isolators, all-directional acoustic pipe anchor, and pipe guide. Steel springs shall be a minimum of 0.75"

except in those expansion locations where additional deflection is required to limit load changes to +25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

3.2 SEISMIC CONTROL

3.2.1 All mechanical and electrical systems are to be seismically restrained. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical (equipment not listed is still included in this specification).

3.2.2 Vibration Isolation Bases: Mount equipment on structural-steel bases or concrete inertia bases as required.

3.2.3 Component Importance Factor is 1.5 for the following Mechanical and Electrical Systems (All other Systems shall have a Component Importance Factor of 1.0):

3.2.3.1 Fire Protection System, and all other complete system components required to operate these systems,

3.2.3.2 Utility and service line at structure interfaces, and all other complete system components required to operate these systems,

3.2.3.3 Interior natural gas piping and gas-fired appliances, and all other complete system components required to operate these systems,

3.2.3.4 Water heaters, accessories and components, piping and associated concrete pad, and all other complete system components required to operate these systems,

3.2.3.5 Boilers, accessories and components, piping and associated concrete pad, and all other complete system components required to operate these systems,

3.2.3.6 Fluid Cooler, accessories and components, piping and associated concrete pad, and all other complete system components required to operate these systems,

3.2.3.7 All lighting systems including fixtures, controls, emergency power, etc.

3.2.3.8 Fire Alarm System.

3.2.3.9 Emergency Power System and all wiring, including branch circuits and feeders.

3.2.3.10 Electrical connections, equipment, etc. associated with all mechanical equipment.

3.2.3.11 Nurse call system.

3.2.3.12 Normal power feeders and branch circuits.

3.2.3.13 Also, the interrelationship of components and their effect on each other shall be considered so that the failure of any essential or non-essential architectural, mechanical or electrical component shall not cause the failure of another essential architectural, mechanical or electrical component.

3.2.4 Snubbers: Install the required number of seismic snubbers on each spring-mounted piece of equipment. Locate snubber as close as possible to the vibration isolators and bolt to supporting structure.

3.2.5 Manufacturer shall provide installation instructions, drawings and trained field supervision to insure proper installation and performance. Visit the project site before installation is begun and instruct installers in

correct installation procedures for vibration isolation, seismic restraints and concrete pads. Observe installation of other work related to vibration isolation and seismic work, including concrete pad installations; and, after completion of other related work(but before equipment startup), shall furnish written report to Contractor listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover the following:

3.2.5.1 Equipment installations (performed as work of other sections) on vibration isolators and Seismic restraints.

3.2.5.2 Conduit connections including flexible connections.

3.2.5.3 Passage of conduit and cable trays which is to be isolated through walls and floors.

3.2.6 Do not start-up equipment until inadequacies have been corrected in manner acceptable to Vibration Isolator and Seismic Controls Manufacturer.

3.2.7 Spacing for restraints shall be as follows, except where lesser spacing is required to limit anchorage loads:

3.2.7.1 Ductwork and electrical services (conduit, bus ducts, cable trays, and ladder trays) transverse restraints shall occur at 30’ intervals (or at both ends of the duct run if less than specified interval) and longitudinal restraints shall occur at 60’ intervals (with at least one restraint per duct run). Transverse restraints shall be installed at each duct/electrical services turn and at each end of a duct/electrical run.

END OF SECTION

DIVISION 26 - ELECTRICAL

SECTION 265113 - LIGHTING FIXTURES AND LAMPS

PART 1 – GENERAL:

1.1 Furnish and install all lighting fixtures, as herein specified, complete with lamps and accessories for safe and effective operation. All fixtures shall be installed and left in an operable condition with no broken, damaged or soiled parts.

1.2 All items furnished shall comply with the latest standards applicable such as U.L., NEMA, etc., and shall bear labels accordingly. All fixtures shall be the color specified or as selected by the Architect. Wherever fixtures have evident damage, they shall be restored to new condition or shall be replaced. Likewise, fixtures showing dirt, dust or finger prints shall be restored to new condition or shall be replaced.

1.3 Eight copies of light fixture factory shop drawings and cuts, showing fixture dimensions, photometric data, installation data and, if applicable, air handling data, shall be submitted to the Engineer for written approval 30 days after bid date. (Verify shop drawing quantities with the Architect.)

1.4 Locate pendant, surface mounted or chain-hung industrial fixtures in mechanical rooms and similar spaces to avoid ductwork and piping. Locate around and between equipment to maximize the available light. Request a layout from the Engineer if uncertain about an installation.

1.5 Alternate fixtures may be substituted for types specified by name or catalog number. Proposed substitutions must be submitted to the Engineer ten working days prior to bid date for written approval to bid. This written approval will only be issued in addendum form.

1.6 Where emergency battery packs are provided with fixtures (if any), they shall be connected to an unswitched power line and wired in accord with the manufacturer's recommendations.

1.7 All reflecting surfaces, glass or plastic lenses, ballast housings, parabolic louvers, downlighting Alzak cones and specular reflectors shall be handled with care during installation or lamping to avoid fingerprints or dirt deposits. It is preferred that louvers be shipped and installed with clear plastic bags to protect louvers. At close of project, and after construction air filters are changed, remove bags. Any louver or cone showing dirt or fingerprints shall be cleaned with solvent recommended by the manufacturer to a like-new condition, or replaced as necessary in order to turn over to the Owner new fixtures at beneficial occupancy.

1.8 Where fixtures are scheduled to be provided with quartz restrike relay and lamp, for auxiliary or emergency illumination, the controlling relay shall be configured to energize the lamp on cold start or hot lamp restrike.

1.9 Refer to architectural details as applicable for recessed soffit fluorescent fixtures or wherever fixture installations depend upon work of other trades. Coordinate all installations with other trades. Verify dimensions of spaces for fixtures, and if necessary, adjust lengths to assure proper fit and illumination of diffuser and/or area below.

PART 2 – VOLTAGE:

2.1 All lighting fixtures will be rated 120, 277 or 480 volts, single phase as indicated or required.

PART 3 – BALLASTS:

3.1 Electronic Ballast Specification

3.1.1 Fluorescent ballast to be high performance electronic to operate at a frequency of 20KHz or higher with less than 2% lamp flicker, at an input voltage of 108 to 132 VAC (120 volt line) or 249 to 305 VAC (277 volt line) at an input frequency of 60 Hz minimum of .88 ballast factor, power factor of .98. Light output to remain constant for line voltage of ± 4%. Ballast to comply with EMI and RFI limits set by FCC (CFR 47 part 18) for normal electrical equipment and have less than 1.4 lamp current crest factor (or less if required by the fluorescent lamp supplier). Verify this prior to submitting shop drawings. Ballast to meet ANSI Standard 82.41 and be UL listed Class P Type I. Ballast shall be non-PCB bearing.

3.1.2 Ballast to have less than 10% total harmonic distortion with less than 6% third harmonic distortion. Ballast to have "A" sound rating with a power factor greater than .99 and have a twenty year rated life. Ballasts used shall operate 1, 2, 3, or 4 T8 lamps as specified in the fixture specification. Use a 2, 3 or 4-lamp ballast to match number of lamps in fixture, and meet all switching requirements as shown on the drawings. Ballasts shall be unconditionally warrantied by the manufacturer for a period of three years from project beneficial occupancy.

3.1.3 Motorola, Advance, Universal or Valmont are acceptable manufacturers.

3.1.4 **NOTE**: No single can-4 lamp ballast with 2 source input will be allowed for any fixture(s) shown supplied by both normal and emergency power.

3.1.5 Provide in-line fuse-holder(s), with fuse sized per manufacturer's recommendations for each 277 volt fixture.

3.2 Metallic vapor lamp (H.I.D.) ballast shall be rated 120 or 277 or 480 volts, 60 Hertz energy-saving high power factor, copper wound, auto regulator type for single lamp, complete with external fuse holder (Bussmann HLR) and as manufactured by Jefferson, G.E., or Advance. All vapor lamp ballasts shall be encapsulated or potted to minimize the amount of audible hum produced. No open core and coil ballasts shall be provided unless specifically indicated in the fixture description. Ballast factor for all H.I.D. ballasts shall be 1.0 ± 5% tolerance. Ballast shall deliver full wattage, to match the rating of the lamp, assuming proper input voltage, within the tolerance range noted.

3.3 Where lighting standards have fuses protecting ballasts, an in-line type of fuseholder shall be located at the base of the pole, readily accessible behind the handhole coverplate. Where multiple circuited luminaires are on a single pole, identify the separate fuseholders.

PART 4 – LAMPS:

4.1 Lamps furnished and installed in indicated fixtures shall be as manufactured by G.E., Westinghouse, Phillips, Osram or Venture. Wherever possible, all lamps provided shall be manufactured in the United States of America.

4.2 All incandescent lamps shall be rated 130 volts with a medium screw type base (or as required) in wattages less than 300 watts and 130 volts, mogul screw type base in 300 watts and larger.

4.3 Fluorescent lamp to be T8 (one inch diameter), various lengths, wattages, rapid start with lamp efficacies of over 97 lumens per watt on electronic ballast, 91 lumens per watt on magnetic ballast, with a color rendering index (C.R.I.) of 65 or higher, medium bi-pin base configuration. Normal color to be 4100N Kelvin unless specified otherwise in fixture list. Normal power input to be 32 watts for 48" lamps. Lamps

to have an average life of 15,000 hours at three hours per start. Lamps to operate at 265MA. Osram, Westinghouse, Philips, and General Electric are acceptable manufacturers.

4.4 H.I.D. (low or high pressure sodium, mercury vapor, metal halide) lamps shall be suitable for the specified fixture, and as listed in the fixture schedule. All HID lamps shall be furnished with mogul base, unless otherwise noted or required. H.I.D. lamps used in outdoor fixtures shall have clear envelopes, in indoor fixtures they shall have diffuse coatings unless specifically indicated otherwise.

4.5 Metal halide lamps shall be Osram "Super Metalarc" 4100E Kelvin correlated color and temperature (C.C.T.). Where used in horizontal burning positions, provide with position indicators on base. Consequently, all fixtures specified with horizontal metal halide lamps shall utilize position-oriented sockets, and lamps shall be installed per manufacturer's recommendations. No substitutions are permitted for this brand of metal halide lamp, where indicated for horizontal burning position. All metal halide lamps in any given area shall be the same color temperature rating and C.R.I. Clear lamps shall be 60 C.R.I. minimum, coated lamps shall be 70 C.R.I. minimum.

4.6 Where a fixture containing an HID lamp utilizes a variable - focus or positioning socket, it shall be adjusted for the distribution pattern indicated.

4.7 "MR" incandescent lamps shall be 12 volt rated, with appropriate transformer for an eleven volt secondary voltage or as recommended by the lamp manufacturer, with matching dimmer where dimmers are indicated, rated specifically for the lamp/transformer combination. Where M.R. incandescent lamps are indicated to be furnished for line voltages, they shall be rated 130 volts.

4.8 Compact fluorescent lamps shall be Phillips "PL", G.E. "Biax" or Osram. All compact fluorescent lamp/ballast combinations shall be rated for high power factor. No low power factor lamp/ballast combinations may be used.

PART 5 - LIGHT FIXTURE GENERAL REQUIREMENTS:

5.1 Fluorescent Recessed Lighting Fixtures - General Requirements

5.1.1 The following are minimum requirements for recessed fluorescent fixtures for lay-in grid, gypsum board, plaster and concealed spline ceilings. Surface-mounted fluorescent fixture requirements shall be similar.

5.1.2 Housings shall be a minimum of 4" depth, premium grade, constructed of a minimum 22 gauge die embossed or stiffened cold rolled pre-treated rust-resistant steel. Troffers shall be equivalent to Hubbell "Versaline," Daybrite "Designer," Lightolier equivalent or Lithonia "2SPG" series.

5.1.3 All parts shall be finished with polyester powder or white baked enamel (85% minimum reflectance) painted after fabrication. All wiring shall be type TFN, or THWN and shall be covered by the steel ballast cover, wiring channel, or socket track. Exposed wiring is not acceptable. Connection wiring shall be accessible thru a hinged access plate above ballast channel in top of unit.

5.1.4 As an option, lay-in troffers may be fitted with preterminated connectors for use with UL listed flexible wiring systems. If this wiring system is proposed by the Contractor, shop drawings shall be submitted and the actual installation drawings shall be included in the project operation and maintenance manuals. Any flexible wiring system proposed shall be approved and acceptable to the lighting fixture manufacturers of the types to be connected.

5.1.5 Ballasts shall be as specified. If a manufacturer and series number is listed, substitution by other manufacturers shall be of the exact same specification (sound rating, energy consumption, life expectancy, warranties, physical size, heat and temperature ratings), etc. All ballasts shall be cool operating, of the electronic energy-saving type, UL and CBM listed.

5.1.6 The complete light fixture unit shall be UL listed and labeled. Other agency listings may be acceptable with written approval from the Engineer.

5.1.7 Fixture lens doors shall be reversible, hinged, painted after fabrication, with spring-loaded or other mechanically stable positive action latches.

5.1.8 Lens shall be as specified for each fixture type. If a specific manufacturer and series number of lens is listed, the substitute shall be of the exact specification (thickness, prism configurations, transparency, efficiency, photometric distribution, hardness, vandal-resistance, etc.). Minimum average thickness of any prismatic lens shall be .125".

5.1.9 Fixture trim and/or flanges shall conform with ceiling constructions as required. Verify all types prior to submission of shop drawings and indicate any special types on submittals. Fixtures installed in drywall or plaster ceilings to be provided with flange, screed and swing gate anchoring system.

5.1.10 All fixtures shall be furnished with hold down clips to meet applicable seismic codes, four clips per fixture minimum or the equivalent thereof in the installation trim. Verify thickness of drywall or plaster ceilings prior to submission of shop drawings, to allow for proper trim adjustment.

5.1.11 Support fixtures with one hanger wire at each end. Hanger wires shall be installed within 15º of plumb, maximum or additional support shall be provided. Wires shall be attached to the fixture body and to the building structure - not to the supports of other work or equipment.

5.1.12 Each type of fluorescent (or other type) lay-in fixture shall be furnished with the proper housing flange or lip to suit the type of lay-in grid(s) being utilized on the project. The Contractor is to verify if narrow or standard grid members are being furnished and provide the proper type of light fixture trim. Indicate any special trims on shop drawing submittals.

5.1.13 Lamps shall be as specified in lamp section of these specifications, and suitable for use in the fixture intended. If the lighting fixture manufacturer requires a specific lamp for optimum performance, that lamp shall be furnished.

5.1.14 Do not provide pressure-lock or any other type of lampholder unless specifically indicated to the contrary or required by local codes. Fixtures may be shipped from the factory with lamps installed, at the Contractor's option.

5.2 Industrial and Striplight Fluorescent Fixtures - General Requirements

5.2.1 Units shall have die-formed heavy gauge cold rolled steel channels and die-embossed reflectors.

5.2.2 Finishes to be coated with a gloss powder paint or baked enamel finish with a minimum 85% reflectance.

5.2.3 Units to have aligner clips where required for a continuous row appearance. Where continuous rows exceed twelve feet in length, provide a "unistrut" channel or similarly adequate mounting to stiffen and align row.

5.2.4 Units to have captive latches for ballast covers, heavy-duty lampholders and wire guards where specified. Wire guards shall be heavy-duty #14 wire gauge) minimum with corrosion-resistant plated or vinyl finish.

5.2.5 Ballasts to be as specified herein.

5.2.5.1 Units to be UL listed.

5.2.5.2 Mounting brackets and hanging mechanisms shall be as specified in fixture descriptions, or as required. Allow a generous safety margin with all support systems, as recommended by the manufacturer.

5.3 Recessed Ellipsoidal or Parabolic Cone Downlight - General Requirements

5.3.1 Fixture to have an extruded or die-cast aluminum lampholder housing. Retaining mechanism shall provide easy access to lamp and ballast junction box. Lamp holders shall be U.L. listed, compatible with the lamp type specified. All sockets shall be porcelain or high temperature plastic. No bakelite or fiber material shall be used.

5.3.2 Unit to have a corrosion-resistant steel junction box with hinged access covers and thermal protector.

5.3.3 Mounting/plaster frame to be heavy gauge steel with finishing trim friction support springs, for the required ceiling thickness. Trim to be of color as selected by the Architect.

5.3.4 Optical system to consist of a specular clear Alzak upper ellipsoidal (or parabolic, as noted) reflector with specular Alzak cone or microgroove matte black baffle as noted in schedule. Units shall have a UL approved clear tempered glass protection lens where used with metal halide or quartz lamp. Where other than clear Alzak cone/reflector color is noted on the schedule, it shall be furnished as specified.

5.3.5 Ballast to be HPF CWA 120 or 277 volt. Fixture to have a prewired, encased and potted ballast tray module. Ballast to be lowest sound rating available for the class and wattage of lamp.

5.3.6 Provide telescoping channel bar hangers that adjust vertically and horizontally.

5.3.7 Minimum flange shall match cone finish or provide painted color as selected by the Architect on black microgroove baffle types.

5.3.8 Lamps shall be as specified in lamp section of these specifications.

5.3.9 Fixtures to be UL listed for thru-branch circuit wiring, recessed, and damp locations. Where installed in plaster or drywall or other inaccessible ceiling type, they shall be U.L. listed for bottom access.

5.3.10 Refer to other sections of this specification for quartz restrike option requirements.

5.4 Exit Lights - General Requirements

5.4.1 Housings and canopies shall be die-cast aluminum or corrosion resistant steel. Mountings shall be wall or ceiling, universal type, to suit the installation conditions.

5.4.2 Provide with stencil face, lettering color red, of sizes in accord with code, or as otherwise specified.

5.4.3 Provide single or double face as scheduled, indicated on plans or as required by the local authority having jurisdiction. Adjust installation position if required for clear visibility, in accord with applicable codes.

5.4.4 Complete unit to be finished in color as selected by the Architect.

5.4.5 Provide directional arrows as indicated on plans, as scheduled to suit the means of egress or as required by the local authority having jurisdiction.

5.4.6 Lamps shall be long-life type, as specified.

5.4.7 Where emergency backup battery packs are provided with exit lights, they shall have capacities for continuous operation per applicable codes. They shall have reserve battery capacity to operate remote lamps where indicated.

5.5 H.I.D. Lighting Fixtures - General Requirements

5.5.1 For recessed indoor/outdoor fixtures, housing to be maximum of 20" high, constructed of 22 gauge die-formed, cold rolled steel finished with polyester powder (85% gloss, 89% reflectance) or baked enamel paint. Unit to be painted after fabrication.

5.5.2 Surface-mounted indoor or outdoor fixtures shall have aluminum or steel housings as specified, finish or color as selected, wet or damp location U.L. listing as required and full gasketing to prevent insect entry. Provide charcoal or equivalent filter to allow fixture optical assembly to "breathe" for totally enclosed, gasketed fixtures.

5.5.3 All wiring to be Type TFN or THWN; all wiring shall be enclosed by ballast covers, flexible conduits, or socket enclosure.

5.5.4 Fixtures to have vertical lamp and extruded or die-cast aluminum heat dissipating finned socket housing. Socket shall be porcelain, with lamp shell to be nickle-plated, split type, 4 or 5 KV pulse rating, per U.L. Standards.

5.5.5 Where fixtures are scheduled to have metal halide lamps, provide with clear tempered glass shield below lamp.

5.5.6 Provide fixtures with high power factor constant wattage auto-transformer (CWA) 120, 277 or 480 volt (as specified or required) ballast, solidly anchored on hinged plate or power drawer that is easily accessible from below fixture. Provide ballast with single or double fusing as needed. Ballasts shall be encapsulated type, lowest available sound rating for the class and wattage of lamp specified. Also see Part 3 above for additional requirements.

5.5.7 Provide trim for lay-in, plaster, drywall, etc. applications as needed for recessed fixture.

5.5.8 Lamps shall be as specified elsewhere in this section.

5.5.9 Refer to other sections of this specification for quartz restrike option requirements.

PART 6 - LIGHTING FIXTURE SCHEDULE:

6.1 Note: Each vendor proposing to bid the materials specified herein below is cautioned to review all requirements of the Contract Documents, as they may apply to the work involved, particularly Specifications Section 265113 - Articles 1 thru 5. The general materials requirements are to be met in their entirety by the contractors and vendors supplying these materials. Note: Unless otherwise noted, all 48" dimension fixtures shall be provided with 48" T8 32 watt 2900 lumen 4100ºK C.C.T. lamps, quantity as specified, with companion 2, 3 or 4 lamp electronic ballasts. Where fixtures with ballasts have switches that controls lamps individually or in groups, the proper number of separate ballasts shall be provided. Refer to the drawings for specific control information.

6.2 TYPE DESCRIPTION

Refer to drawings for schedule

PART 7 – PHOTOCELLS:

7.1 Provide 120, 277 or 480 volt (rated as needed), 1000 or 2000 watt photocells as needed for control of certain circuits or fixtures as indicated on plans. They shall be as manufactured by Tork, Paragon, AMF or approved equivalent.

7.2 Mount photocells in locations concealed from sight lines standing on ground unless otherwise noted, in which case the final position shall be as directed by the Architect. Group together (if indicated at one location) and mount on back of parapet wall or otherwise properly support with mounting bracket. Coordinate with roofing installer to ensure that roof penetrations are properly made without violating or reducing the roof warranty in any way. Photocells may be mounted in other locations if it is not practical to install them on roofs or parapets, in which case the Contractor shall request direction for their mounting locations from the Engineer or Architect. Photocells shall always be mounted in a weatherproof, inconspicuous manner.

PART 8 – TIMECLOCKS:

8.1 Provide synchronous motor-driven or quartz-digitally based timeclock(s) to control the indicated loads. The number of poles, their ampacity and voltage withstand shall be to suit the load, but in no case less than 30 amps, 277 volts.

8.2 Timeclock coil and motor power shall be 120 volts AC, backed up with seven day spring winder (or the electronic equivalent) which is automatically replenished in normal operation. Provide a 120 volt control circuit from the nearest available panelboard. If quartz-based timeclocks are used, they shall have a lithium or rechargeable battery backup to prevent memory loss.

8.3 Provide with an astronomical dial, set up and calibrated for the week and month the timeclock is placed in operation. Order unit for the proper geographical latitude for the project site. Digital timeclocks may be substituted for the electro-mechanical type, assuming they meet the same requirements. Also provide day light savings time option and calibrate for April-October dates. Provide instruction to the Owner's representative in proper setting and operation of each type of timeclock provided.

8.4 Enclosures for timeclocks shall be surface type, NEMA 1 or NEMA 3R as needed. Where exposed in finished areas, provide flush-style NEMA 1 enclosures.

END OF SECTION.