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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 NEC – National Electrical Code (NFPA 70).

1.10.10 BAS – Building Automation System.

1.10.11 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.

1.11 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 approval 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 judgment 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 this procedure is not followed, the substitution will be rejected. 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 to the Owner, 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 (SCHEDULE OF VALUES)

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.

8.2 The breakdown shall be minimally as follows. Material and labor shall be listed separately. Pay special attention to required withholding percentages for startup, testing, documentation, acceptance, owner training, etc.:

- Permitting
- Mobilization
- Shop Drawings/Submittals
- Temporary Power
- Interior Lighting Materials & Labor
- Exterior Lighting Materials & Labor
- Lighting Controls Materials & Labor
- Electrical Distribution (Switchgear) Materials & Labor
- Feeders Materials & Labor
- Branch Circuiting Materials & Labor
- Service Grounding Materials & Labor
- Electrical Devices Materials & Labor
- Ladder/Cable Trays Materials & Labor
- Fiber/Communication Duct Banks Materials & Labor
- Fire Alarm Materials & Labor
- Low-Voltage Data/Voice Cabling Materials & Labor
- Data/Voice Equipment Materials & Labor
- Audio/Video Equipment and Cabling Materials & Labor
- Access Controls Equipment and Cabling Materials & Labor
- CATV Equipment and Cabling Materials & Labor
- Security Equipment and Cabling Materials & Labor
- Generator Materials & Labor
- Automatic Transfer Switches Materials & Labor
- Spare lamps and ballasts
- Lighting Controls Start-up
- Generator Start-up and Testing
- Owner Training & Acceptance
- As-Built/Record Drawings & Acceptance
- O&M Manuals & Acceptance
- Warranty
- Demobilization

PART 9 - GUARANTEES AND WARRANTIES

9.1 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.

PART 10 - INSPECTION, APPROVALS AND TESTS

10.1 Before requesting a final review of the installation from the Architect and/or Engineer, each 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 Owner's and Engineer's inspections: Two inspections will be held to generate and then review punchlist items. All site visits thereafter shall be billed to the Contractor at the Engineer's standard hourly rates.

10.3 The Contractor shall provide as a part of this contract electrical inspection by the City of Louisville Electrical Inspector, licensed to provide such services. All costs incidental to the provision of electrical inspections shall be borne by the Contractor.

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-in as well as finished work. The rough-in 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 the original and 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

REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 12 - CLAIMS FOR EXTRA COST

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 benchmarks. 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 between 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.

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 with the General Contractor or Construction Manager 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.

15.2 All temporary services shall be removed by Contractor prior to acceptance of work.

PART 16 - RECORD DRAWINGS

16.1 Note: Also, refer to additional record drawing requirements within the general conditions and other sections of these specifications.

16.2 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 as a system is completed, within ten days of the mark-up and/or while the accuracy of the mark-ups can be verified visually. Monthly payment may be withheld if the requirement is not complied with.

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 underground, 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. Raceways shall not be placed within foundation walls and footings

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 companies and workmen normally engaged or employed in these respective trades.

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 permanent dismissal of that workman from the project. 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 and Structural 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. The Contractor is responsible for the correct location of all rough-in and connections at every piece of equipment. Work not correctly located shall be relocated at the Contractor's expense.

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 and weather 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. Electrical equipment exposed to the weather shall be replaced by the Contractor at his expense.

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 3500 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 in center 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. Turn down edges 18” below grade.

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

23.1 The Contractor shall replace 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. Patchwork on new construction will not be accepted.

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 Part 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 and mark all utilities or lines that would be endangered by the excavation. Contractor shall bear costs of repairing damaged utilities.

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 and proper testing. 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: 14 gauge aluminum brushed satin finish, 1" border.

29.4.2 In finished areas: 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 Division 20, 21, 22, 23 and 25 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 Division 26 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 or manufacturer with conduit terminal box, adequate starting and internal thermal overload protective equipment as specified or required. The capacity 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. Also, see Division 20, 21, 22, 23 and 25 of Specifications for further requirements and scheduled sizes.

PART 32 - CUTTING AND PATCHING

32.1 Unless otherwise indicated or specified, each Contractor shall provide his own 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 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 Galvanized steel sleeves shall be provided for all electrical conduit passing thru concrete floor slabs and concrete, masonry, tile and gypsum wall construction.

33.3 Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be sealed with an approved product, 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 ½ 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 with copy to the Owner and Architect 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. Each section shall be properly tabbed, indexed and labeled, with a table of contents.

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 Each 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 Each 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

and/or Architect 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 and exposed on exterior 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 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.

40.5 No asbestos containing material shall be installed on the project.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260005 - DESCRIPTION OF ELECTRICAL SYSTEM

PART 1 – ELECTRICAL - PRIMARY SERVICE

1.1 Primary electrical service is a new underground, nominal 13,800 volts, three phase, wye, to a pad-mount transformer as indicated on the plans.

1.2 Provide primary conduit, primary conductors, manholes, concrete pads, pull ropes, trenching per specifications and drawings.

PART 2 - SECONDARY SERVICE

2.1 Secondary service is a new 4000 Amp/277/480V/3Ø/4W with solid grounded neutral.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260010 - SCOPE OF THE ELECTRICAL WORK

PART 1 - GENERAL

1.1 Each Electrical Contractor's attention is directed to Section 260000 - 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:

2.1.1 All conduits, cable trays, J-hooks, conductors, outlet boxes, fittings, etc.

2.1.2 All switchgear, panels, disconnect switches, fuses, transformers, contactors, etc.

2.1.3 All wiring devices and device plates.

2.1.4 All light fixtures, ballasts and lamps.

2.1.5 Electrical connection to all electrically operated equipment furnished and/or installed by others, including gymnasium equipment, mechanical equipment, etc.

2.1.6 Program/paging system, including equipment, wiring, terminal plates, service cables, etc., for the classroom system as described herein, as well as plates, wiring, terminations for a second owner-installed digital telephone system.

2.1.7 Inspection of electrical system by an approved Electrical Inspector, in compliance with local requirements.

2.1.8 Fire alarm system.

2.1.9 Grounding, per N.E.C. and the specified requirements.

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

2.1.11 All necessary fees and cost for permits, inspections, work by utility companies, etc. Provision of electrical power, telephone and cable television services into the building from the utility termination points outside.

2.1.12 Video system, including antennas, cabling, electronics, terminal plates, service conductors, etc.

2.1.13 Cabling, testing and devices for data/voice network.

2.1.14 Special Note: A specialty sub-contractor (Electronic Systems Contractor) shall be utilized to install all video systems, paging-intercom system, data/voice network, fire alarm system, sound systems, video surveillance system and security system. The sub-contractor shall be especially skilled in such work and shall be able to demonstrate that their regular business involves such installations. The specialty sub-contractor(s) shall be acceptable to and approved by the Owner. The names of each such sub-contractor shall be listed on the form of proposal at the time of opening bids. The Contractor is not permitted to install or work on these systems.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260015 - COORDINATION AMONG TRADES, SYSTEMS INTERFACINGAND 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, soffitts, 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 new services.

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

2.1.3 Connection of all controls to equipment.

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

2.1.5 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 260020 - SHOP DRAWINGS, LITERATURE, MANUALS, PART 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:

Power Equipment

- Switchgear, switchboards and panelboards.
- Circuit breakers or fusible switches, per each type.
- Power and lighting contactors.
- Disconnect switches.
- Fuses, per each type required.
- Magnetic starters, if not submitted with unit equipment by supplier.
- Control components (relays, timers, selector switches, pilots, etc.)
- Building service grounding electrode components.

Raceways

- Cable tray and each type of cable tray fitting.
- Wireways and each type of wireway fitting.
- Surface raceways and fittings.
- J-hook assembly.

Devices

- Each type of wiring device and their coverplates.
- Floor boxes, each by type, with required accessories.
- Data/voice/video wallplates, each by type.
- Any special items not listed above.

Lighting

- 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.
- Lamps and ballasts, each by type.
- Lighting standards or poles.
- Photocells, time clocks or other lighting accessories.
- Control systems (lighting).

Systems

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 the specific system's specification for additional submittal requirements where required.

- Fire alarm system.
- Security system.
- Building paging/intercom audio system.
- Video system.
- Data/voice network.
- Audio/video system(s).

Miscellaneous

- Control panel assemblies.
- Non-standard junction/pullboxes.

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.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260030 - CUTTING, PATCHING AND REPAIRING

PART 1 - GENERAL

1.1 Each Electrical 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 coordinate with the General Contractor 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 Each Electrical 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 Each Electrical Contractor shall cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.

1.4 Each Electrical 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 exterior wall (none are permitted thru roof) 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. All roof penetrations shall be made inside mechanical equipment curbs.

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 Each Electrical 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 the General Contractor at the direction of the Contractor whose work is affected. The cost of this work shall be paid for by the Contractor responsible.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260040 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

PART 1 - GENERAL

1.1 Each Contractor's attention is directed to Section 260000, General Provisions, Electrical and all other contract documents as they may apply to his work.

1.2 Each 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. Telephone or cable TV services shall, in all cases, be placed in a separate trench with minimum two feet separation from electrical power lines.

1.4 Depths of bury shall be:

1.4.1 48" minimum to top of primary ducts, unless otherwise noted.

1.4.2 36" minimum to top of secondary ducts, unless otherwise noted.

1.4.3 36" minimum to top of branch exterior circuits, unless otherwise noted.

1.4.4 36” minimum to top of telephone/communication/misc. ducts, unless otherwise noted.

1.5 Subsurface investigations have been made and the results shown on the drawings. The information was obtained primarily for use in preparing foundation design. Each 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.

1.6 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 2 – EXCAVATION

2.1 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.

2.2 Each 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.

2.3 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.

2.4 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 3 – BACKFILL

3.1 Backfill trenches only after conduit and cable have been inspected by Agencies, Engineer and Owner, tested, and locations of pipe lines have been recorded on record drawings. Provide at least one week's written or fax notification to all parties of impending work that needs to be reviewed.

3.2 Backfill shall be accomplished with clean debris free earth and the backfill compacted to 95% standard Proctor in 6" lifts 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.

3.3 The backfill below paved areas shall be brought to proper grade in 6" lifts compacted to 98% standard Proctor to receive the sub-base and paving. No paving shall be placed on uncompacted fill.

3.4 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 260060 - 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 3/4" minimum diameter, ten feet long, copperweld steel. All ground electrode systems shall be installed in accord with manufacturer's recommendations, UL 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 feasible 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 Equipment grounding conductors shall be run to lighting fixtures, devices, receptacles, electric heaters, furnace and other equipment. Equipment grounding conductors not exceeding #6 AWG in size shall be green colored Type "THWN". Those larger than No. 6 shall be green (same color everywhere) taped 4" at each termination, pull and junction boxes.

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 NEC, and shall not exceed five ohms.

3.5 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.

3.6 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.

3.7 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.

3.8 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 #500 Kcmil 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.

3.9 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 UL and manufacturer's recommendations.

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

3.11 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.

3.12 **At all metallic outlet, junction and pull boxes, bond the equipment grounding conductor to the box.**

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260075 - IDENTIFICATIONS

PART 1 - GENERAL

1.1 Equipment, disconnect switches, switchgear, switchboards, panelboards, transformers, motor starters, sound equipment, 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 1/2" black lamacoid plate (or equivalent) with white letters 1/4" high.

1.2 Each Electrical Contractor shall provide clearly legible typewritten directories in each electrical panel indicating the equipment, location within area, and area or room of circuit, etc. controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic cardholders in each panel. Descriptions to be approved by the Owner.

Example: 1 Lights, East Side, Room 100
3 Receptacles, West Wall, Room 200

1.3 Branch circuit panelboards and switch gear shall be provided with a black lamacoid plastic plate with 1/2" white letters for panel designation and 1/4" 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. Refer to drawings for detail.

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 ½" letters. Also provide similar plates and legends for automatic transfer switches, as appropriate. Refer to drawings for detail.

1.5 Lamacoid plates shall be located at center of top of trim for branch circuit panelboards, switchboards, switchgear, 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 260120 - 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 seven current carrying conductors and no more than ten total conductors shall be installed in conduit except for switch legs and travelers in multi-point switching arrangements.

1.5 Neutrals shall not be shared. All branch circuits shall be provided with separate neutrals.

1.6 If more than three phases are installed in a single raceway, an additional equipment grounding conductor 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 #12 AWG 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 #12 AWG and #10 AWG shall be solid. Conductors #8 AWG and larger sizes shall be stranded.

2.1.4 Conductors for fire alarm wiring shall be stranded and in full compliance with NEC 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 260120 – Part 4, Color Coding.

2.1.7 All equipment grounding conductors shall have green color insulation or if larger than #8 AWG, 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 labels indicating source, circuit number or terminal number.

2.1.11 Branch wiring and feeder conductors that are greater than 50' 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.

2.1.12 MC cable may not be used.

2.2 SPLICING DEVICES & CONNECTORS

2.2.1 Splicing devices for use on #10 AWG or smaller conductors shall be pressure type

2.2.2 Wire nuts shall be spring pressure type, insulation 600V, 105NC 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 #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.

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 Aluminum conductors shall not 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 NEC 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 XHHN or XHHW and 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 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 5 - MEDIUM VOLTAGE PRIMARY CABLE

5.1 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.

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

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

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

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

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

5.7 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.

5.8 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.

5.9 Electrical ratings shall be as follows:

Voltage	15 KV class
Continuous and Load Break Current	Refer to drawings
BIL	95 KV
Withstand Voltage (AC)	34 KV, 60 HZ, 1 minute
Short-Time Current	10,000 amps, rms, sym., .17 seconds.

5.10 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.

5.11 The connectors shall have the following ratings:

Voltage	15 KV Class
Continuous Current	600 amps, rms
BIL	95 KV
8 Hour Overload	900 amps, rms
Withstand Voltage (AC)	35 KV, 60 Hz, 1 minute
Momentary	25,000 amps, rms, sym, .17 seconds.

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

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

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

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

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

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

5.15 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.

5.16 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.

5.17 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 6 - TESTING OF PRIMARY CABLE

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

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

Associated Research, Inc
J.G. Biddle Company
Hipotronics, Inc.
Von Corporation

6.1.2 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.

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

6.1.4 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.

6.1.5 Test: (as appropriate)

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

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

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.

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

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

6.1.8 Proof test on existing cable at 35 KV for 5a and 35 KV for 5b above.

6.1.9 After test (in order listed):

Turn tester power off.
Discharge tester and cable thru a resistive discharge device (8 MEGOHM discharge stick).
Ground cable thru a grounding means (#12 AWG THW wire to ground).
Disconnect tester.

6.1.10 For Safety:

Wear high voltage gloves at all times.
Treat cable and tester as high voltage at all times.
Remember, D.C. static charges can be very harmful.

6.1.11 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 260130 - 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 Division 26 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 (EMT).
1.3.2 Intermediate metal conduit (IMC).
1.3.3 Rigid galvanized steel conduit (GRS)
1.3.4 Flexible metal conduit
1.3.5 Liquid - tight flexible metal conduit.
1.3.6 Rigid nonmetallic conduit.
1.3.7 Surface metal raceways.
1.3.8 Cable tray or cable trough.
1.3.9 Duct banks, and their construction.

1.4 For each piece of cord-connected or flexible conduit connected items of equipment in the kitchen, provide a "Kellems" or equivalent strain relief grip at each end of connector, to prevent pullout if equipment is rolled or shoved by cleaning personnel.

1.5 Refer to the Architect's details for fire-rated grids and gypsum board expanses that protect certain areas of the steel construction of the building. This rated partition shall not be penetrated by electrical or mechanical work unless absolutely necessary and then equivalent fire stopping methods to restore the rating of the plane shall be provided.

1.6 No electrical raceways are to be embedded horizontally within the concrete slabs. Note that all piping, conduit, etc., penetrations thru precast planks shall be done in a manner approved by the precast installer. All sleeves for lines run thru precast horizontal planks or grade beams shall be coordinated by each trade with the General Contractor, the Precast Manufacturer and in a manner as approved by the Architect and Structural Engineer.

1.7 All raceways, as listed in 1.3 above and otherwise specified herein shall be provided in compliance with latest editions of all applicable UL, NEMA, NEC and ANSI 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.

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

1.9 PVC 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.

1.10 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.

1.11 Minimum size of conduit shall be 3/4" 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.

1.12 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, (EMT) of corrosion-resistant steel construction shall be permitted for concealed installation in dry interior locations. Electrical metallic tubing shall not be installed underground, 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 PVC 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 or cables of over 600 Volts.

2.2.3 “Kwik-Couple” is not acceptable.

2.3 INTERMEDIATE METAL CONDUIT

2.3.1 Unless otherwise indicated on the drawings, intermediate metal conduit (IMC) 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 FLEXIBLE METAL CONDUIT

2.4.1 Flexible conduit may be used only where required for connection to light fixtures, motors and other equipment subject to vibration. It shall be constructed of steel. It shall be installed with clamp-on, insulated throat 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. Maximum length shall not exceed 6' for light fixture and 3' for other connections. Use of MC cable is not permitted.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

2.5.1 Weatherproof flexible metal conduit shall be wound from a single strip of steel, neoprene covered. It shall be installed in such a manner that it will not tend to pull away from the connectors. Provide strain relief fittings as required where subject to vibration. Flexible connections to motors in dusty areas shall be dust-tight, in areas exposed to the weather - weatherproof. Length shall not exceed 3' unless permitted by the Engineer.

2.6 RIGID NON-METALLIC CONDUIT

2.6.1 Rigid non metallic conduit shall be constructed of PVC, nominally schedule 40 weight, encased in concrete wherein underground locations. 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. It shall be UV-resistant, rated for 90 degree C conductor temperature.

2.6.2 Rigid non-metallic conduit may be used in exterior wet or damp locations where installed 6" 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. Where used underground, provide continuous marker tape with metallic tracer above line as required.

2.6.3 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 EMT or other approved conduit for remainder of run.

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

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

2.7 SURFACE METAL RACEWAYS

2.7.1 Surface metal raceways shall only be provided where indicated on the drawings.

2.7.2 Surface metal raceways and fittings shall be constructed of code gauge corrosion-resistant galvanized steel, and finished in an ivory color. Finishes shall be suitable for field painting, prepared by the installing contractor as necessary. Surface metal raceways shall be painted to match wall color.

2.7.3 Surface metal raceways to be furnished with integral receptacles shall have Simplex Nema 5-20R outlets spaced on centers as indicated on plans.

2.7.4 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 - bends are not permitted. 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.

2.8 DUCT BANKS

2.8.1 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.

2.8.2 All concrete used in duct bank construction shall be 3000 PSI minimum 28 day compressive strength unless otherwise noted, in accord with latest ACI 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.

2.8.3 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. Provide marker tape with metal tracer above all duct banks as required.

2.8.4 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.

2.8.5 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.

2.8.6 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.

2.8.7 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.

2.9 RACEWAY FITTINGS

2.9.1 Fixture whips shall be 1/2" flexible, with clamp-on steel fittings at each end, six foot maximum length, with insulated throat bushings at each end and bonding locknuts. Wiring thru fixture whips shall be #12 AWG, with #12 AWG ground bonded to outlet at source end.

2.9.2 Conduit bodies shall be of gray iron or malleable iron. 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. Wiring splices within are not permitted.

2.9.3 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.

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

2.9.5 UL listed expansion/deflection fitting shall be provided at all locations where a raceway/conduit crosses a structural joint intended for expansion, contraction or deflection. Other approved means may be acceptable with permission of the Engineer. Provide copper ground bonding jumpers across expansion fittings.

2.9.6 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.. All surface mounted conduit fittings as with "FS", "FD", "GUB" Types etc., shall be provided with mounting hubs.

2.9.7 Where lighting fixtures, appliances or wiring devices are to be suspended from ceiling outlet boxes, they shall be provided with 3/4" rigid conduit pendants. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and #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. Cover pendants shall be finished to match fixtures.

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

2.9.9 Fittings for EMT conduit shall be of steel, compression type. Fittings for sizes larger than 2" shall be setscrew, with two setscrews each side. Conduit stops shall be formed in center of couplings. All EMT connectors and couplings shall be of formed steel construction. All connectors shall be insulated throat type.

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

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

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

2.10 SUPPORTS AND HANGERS

2.10.1 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 UL 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.

2.10.2 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.

2.10.3 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.

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

2.10.5 Individual raceways run on building walls or equipment shall be secured by two-hole galvanized malleable iron or stamped steel pipe strap. 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.

2.10.6 Individual conduits run on building steel shall be secured by means of clamp supports. Provide korn clamps, bulb tee clamps, flange clamps, beam clamps, "minerallacs", etc.

2.10.7 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.

2.10.8 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

2.10.9 The minimum diameter of round all-thread steel rods used for hangers and supports shall be 1/4", 20 threads per inch. All-thread rod shall be furnished with a corrosion-resistant finish.

2.10.10 Welding directly on conduit or fittings is not permitted.

2.10.11 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.

2.10.12 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.

2.10.13 Spring steel clips and fittings with black oxide finish are permitted in any indoor dry location for concealed work, where acceptable to the local authority having jurisdiction.

2.11 FIRESTOPPING MATERIALS

2.11.1 All conduits, and cables penetrating fire rated floors, walls and ceilings shall be fire stopped. Fire stopping assembly must be UL listed. All corridor walls, storage room walls and data/electrical/mechanical room walls shall be considered one-hour fire rated. The mezzanine and second floor slabs shall also be considered one-hour rated.

2.11.2 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.)

2.11.3 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.

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 within the building construction or run above ceilings. Size of all conduits shall conform to Annex C of NEC, unless otherwise shown on the Contract Drawings.

3.2 No conduit shall be installed in or below poured concrete slabs, foundation walls or footings. Conduit shall be held at least 6" from flues or hot water pipes.

3.3 All exposed conduit in mechanical spaces, conduit above corridor ceilings, above gymnasium or other large room ceilings shall be installed on strut system racks 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. Conduits randomly routed will not be accepted.

3.4 Groups of branch circuit conduits shall be run above corridor ceilings where possible, and shall not be routed over classrooms. The conduits from wall outlets in classrooms shall be turned out in the zone between the structure or bottom of the gypsum board fire barrier and the room ceiling directly into junction boxes (fastened to the masonry walls, with a minimum of bends. These branch power, lighting and systems conduits shall then be routed along the walls (or structure, in the case of lighting conduits) to emerge thru the corridor walls at the elevations necessary to route with minimal offset to the racked conduit/junction box system mounted on the bottom of the corridor structure. If in doubt about any particular installation, contact the Engineer for clarification prior to proceeding with rough-in work.

3.5 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 90degree bends.

3.6 Junction boxes shall be installed so that conduit runs will not exceed 85', or as shown on the Contract Drawings. Sizes of junction boxes shall be in accord with Article 370 of the NEC.

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

3.8 All underground or under floor conduits shall be swabbed free of all moisture and debris before conductors are pulled.

3.9 Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the NEC, 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 36" 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 48" to top below finished grade, unless otherwise noted on plans.

3.14 No more than seven conductors shall be installed in conduit without special permission of Engineer, except where switch legs and travelers for lighting controls will be the exceeding conductors or in the case of fire alarm wiring.

3.15 Raceways installed in exterior locations shall receive one coat of primer, two coats finish paint after preparation of galvanizing, color selected by Architect. Exposed raceways in painted interior areas shall be similarly painted.

3.16 Conduits, cables, raceways, and enclosures under metal-corrugated sheet roof decking shall not be located within 1-½” of the roof decking, measured from the lowest surface of the roof decking to the top of the conduit, cable, raceway, or box. GRS and IMC are exempt from this.

3.17 Conduits, cables, raceways, and enclosures are not permitted in concealed locations of metal-corrugated sheet decking type roofing.

3.18 All conduits shall be ¾” minimum.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260135 - 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. Pull boxes shall include all boxes used to reduce the run of conduit to the required number of feet or bends, supports, taps, troughs, and similar applications and shall also be constructed as specified above. 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 panels, shall be provided with code gauge fronts with 1/4 turn fasteners. Fronts for panels shall be as specified under "Panelboards".

2.1.2 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.

2.1.3 Ceiling outlet boxes in exposed areas shall be heavy-duty, die-cast aluminum, 4" round, 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.

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 fully adjustable.

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:

Panels	80" to top
Disconnects	5'-0" max. to centerline

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.

2.2 Cabinets, outlet boxes (FTGS) and junction or pull boxes (FTGS) 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.

2.2.1 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 one (l) or two (2) devices, as required to be flush with face of 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. Circuit numbers for devices shall be written on inside of boxes with permanent marker. 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.

2.2.2 Exterior outlets shall be die-cast aluminum, weather-proof with gasketed covers and baked on grey enamel finish, per ANSI 61.

2.2.3 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.

2.2.4 Boxes for more than two (2) devices shall be for number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.

2.2.5 Outlets for use on this project 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.

2.2.6 Boxes up to 4-11/16 square size shall be fastened to their mounting surface with two fasteners of proper size. Larger sizes shall be fastened with four fasteners, minimum.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260140 - WIRING DEVICES AND PLATES

PART 1 -GENERAL

1.1 This section of the specifications covers all wiring devices and cover plates, standard, weatherproof and dust-tight.

1.2 Wiring devices, listed by manufacturer and catalogue numbers are 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. Note: Pass and Seymour is an acceptable manufacturer.

PART 2 -MATERIALS

TYPE	RATING	CONFIGURATION	COLOR	VENDOR - CAT. #
RECEPTACLE - DUPLEX SPECIFICATION GRADE	125V, 20A	NEMA 5-20R	*	
RECEPTACLE - DUPLEX G.F.I.	125V, 20A	NEMA 5-20R	*	
RECEPTACLE - SINGLE	125V, 20A	NEMA 5-20R	*	
RECEPTACLE, DUPLEX WEATHER RESISTANT, GFI	125V, 20A	NEMA 5-20R	*	
RECEPTACLE, SINGLE WITH CLOCK HANGER TAB, STAINLESS STEEL PLATE	125V, 15A	NEMA 5-15R	METAL	
RECEPTACLE, SINGLE	250V, 50A	NEMA 6-50R	BLACK	
SWITCH, SINGLE POLE	120/277V, 20A	SPST	*	
SWITCH, THREE-WAY	120/277V, 20A	3-WAY	*	
SWITCH, FOUR-WAY	120/277V, 20A	4-WAY	*	
SWITCH, KEYED	120/277V, 20A	SPST	N/A	
SWITCH, KEYED	120/277V, 20A	3-WAY	N/A	

PART 3 - INSTALLATION

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

6.2 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. Any device showing paint or dirt shall be replaced.

6.3 Provide GFCI duplex feed-thru style receptacles where indicated or required by the National Electrical Code, whether specifically called out or not. When a GFCI receptacle is on a circuit with other non-GFCI 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 "GFCI protected" label on each downstream outlet.

6.4 Ground-fault circuit-interrupter shall be installed at a readily accessible location per NEC. Separate device test and reset buttons shall be required where outlets are located behind equipment such as refrigerators and microwaves.

6.5 Where surge suppression outlets are provided, they shall be ANSI Category "A" style. They shall be installed as dedicated-circuit outlets or where 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.

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

6.7 All outlet boxes, in final positions shall be properly fitted, tight to wall, per NEC. No jumbo plates shall be used. All receptacles/grounds shall be "pig-tail" bonded to the outlet box (except for isolated grounds).

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260200 – MEDIUM VOLTAGE SWITCHGEAR

PART 1 - METAL-ENCLOSED LOAD INTERRUPTER SWITCHGEAR:

1.1 GENERAL - SECTION INCLUDES:

1.1.1 Medium voltage compact compartmentalized metal-enclosed switchgear with load interrupter switches close coupled to metal-clad switchgear.

1.2 REFERENCES

- ANSI / IEEE C37.20.3 - Standard for Metal-Enclosed Interrupter Switchgear.
- ANSI / IEEE C37.20.4 - Standard for Indoor AC Medium-Voltage Switches used in Metal-Enclosed Switchgear.
- ANSI / IEEE 24- Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings.
- ANSI / IEEE 48 - Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Termination.
- ANSI Z55.1 - Gray Finishes for Industrial Apparatus and Equipment.
- NEMA

1.3 SUBMITTALS

1.3.1 **T**he metal-enclosed switchgear assembly shall be in accordance with the contract documents, applicable codes and whichever is the most stringent.

1.3.2 The manufacturer shall furnish a detailed Bill of Material and complete set of drawings including:

- Detailed front elevation.
- Single Line
- Floor Plan
- Schematics
- Wiring Diagrams

1.3.3 The manufacturer shall furnish comprehensive instruction manuals covering the installation of the switchgear and the operation of it's various components.

1.4 LOAD INTERRUPTER SWITCHGEAR ASSEMBLY

1.4.1 GENERAL: The metal-enclosed switchgear shall conform to the following specification.

1.4.2 Drawings

- The metal-enclosed switchgear assembly shall be in accordance with the plans and drawings.
- The manufacturer shall furnish, with each metal-enclosed switchgear assembly, a set of drawings complete with a bill of material. The drawings shall include typical front and open side views for each module as well as typical components, their positions, and available space for cable termination; an anchor bolt plan with dimensions; a single-line diagram; and appropriate wiring diagrams.
- The manufacturer shall furnish a comprehensive instruction manual covering installation of the switchgear assembly and operation of the various components.

1.4.3 Ratings

- The distribution system shall be grounded.

- The ratings for the integrated switchgear assembly shall be as designated below.
  - Nominal Voltage, kV_____13.8_____
  - Maximum Voltage, kV_____17_____
  - BIL Voltage, kV_____95_____
  - Main Bus Continuous Current, Amperes___600_____
  - Short-Circuit
  - Amperes, RMS, Symmetrical ____25_____
  - MVA, Three-Phase Symmetrical,
  - at Rated Nominal Voltage_____600_____
  - Two-Time Duty-Cycle Fault-Closing,
  - Amperes, RMS, Asymmetrical____40_____
- The momentary and duty-cycle fault-closing ratings of switches, momentary rating of bus, and interrupting ratings of fuses shall equal or exceed the short-circuit ratings of the metal-enclosed switchgear.

1.4.4 Certification of Ratings

- The manufacturer of the metal-enclosed switchgear shall be completely and solely responsible for the performance of the basic switch and fuse components as well as the complete integrated assembly as rated.
- The manufacturer shall furnish, upon request, certification of ratings of the basic switch and fuse components and/or the integrated metal-enclosed switchgear assembly consisting of the switch and fuse components in combination with the enclosure(s).
- The integrated switchgear assembly shall have a BIL rating established by test on switchgear of the type and kind to be furnished under this specification. Certified test abstracts establishing such ratings shall be furnished upon request.

1.4.5 Compliance with Standards and Codes: The metal-enclosed switchgear shall conform to or exceed the applicable requirements of the following standards and codes:

- ANSI C37.20.3, Standard for Metal-Enclosed Interrupter Switchgear.
- The applicable portions of Article 710 in the National Electrical Code, including Article 710-21(e), which specifies that the interrupter switches in combination with power fuses shall safely withstand the effects of closing, carrying, and interrupting all possible currents up to the assigned maximum short-circuit rating.
- The switchgear manufacturer shall furnish equipment that is listed by Underwriters Laboratories, Inc.
- The following optional feature should be specified as required:
  - The switchgear manufacturer shall provide enclosures that have been proven by Underwriters Laboratories, Inc. to be in compliance with the Category A enclosure test requirements in accordance with conformance standard ANSI 37.57. Category A enclosures are intended to provide a degree of protection against contact with enclosed equipment in ground level installations subject to deliberate unauthorized acts by members of the unsupervised general public. Category A enclosures require the addition of padlockable covers for windows and accessories such as ammeters, voltmeters, kilowatt-hour meters, etc.
- Metal-enclosed switchgear shall be certified to have passed the test requirements of the Electrical and Electronic Manufacturers Association of Canada, “Procedure for Testing the Resistance of Metalclad Switchgear Under Conditions of Arcing Due to an Internal Fault,” G14-1, 1987. The gear shall meet the test requirements for Accessibility Type B: Switchgear with arc-resistant construction at the front, back, and sides.
- Note: Features (4) and (5) can not be specified together. Underwriters Laboratories Inc. does not have a category for arc-resistant switchgear.

1.5 EXAMINATION

1.5.1 Visually inspect switchgear for evidence of damage and verify that surfaces are ready to receive work.

1.5.2 Visually inspect to confirm that all items and accessories are in accordance with specifications and drawings.

1.5.3 Verify field measurements are as shown on drawings as shown on shop dawings.

1.5.4 Verify that required utilities (e.g., control voltage for heater circuits on outdoor switchgear) are available, in proper location, and ready for use.

1.5.5 Beginning of installation means installer accepts existing surface conditions.

1.6 INSTALLATION

1.6.1 Install in accordance with manufacturer's instructions, applicable requirements of the NEC and in accordance with recognized industry practices.

1.6.2 Connect the primary surge arresters if not connected. If required, use jumper cables, as provided by the switchgear manufacturer.

1.6.3 Bending of high-voltage cables should be avoided or minimized. All necessary bends should meet at least the minimum radii specified by the cable manufacturer.

THIS STANDARD DETAILS THE TYPICAL INSTALLATION OF 13.8KV PRIMARY METERING CUBICLE FOR CUSTOMER OWNED SWITCHGEAR.
NOTE:

SWITCH REQUIREMENTS & DIMENSIONS FROM BOTTOM OF BASE ARE AS FOLLOWS:

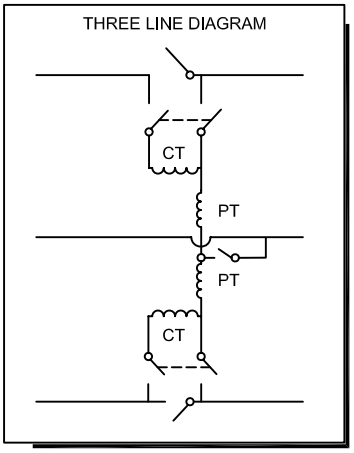
(2)KEARNEY CAT.# 125824-10 15KV 600 AMP BY-PASS OPEN:37 3/4" CLOSED:22 3/4"

(1)KEARNEY CAT.# 127701L 15KV 600 AMP DISCONNECT OPEN:32 1/8" CLOSED:20 1/4"

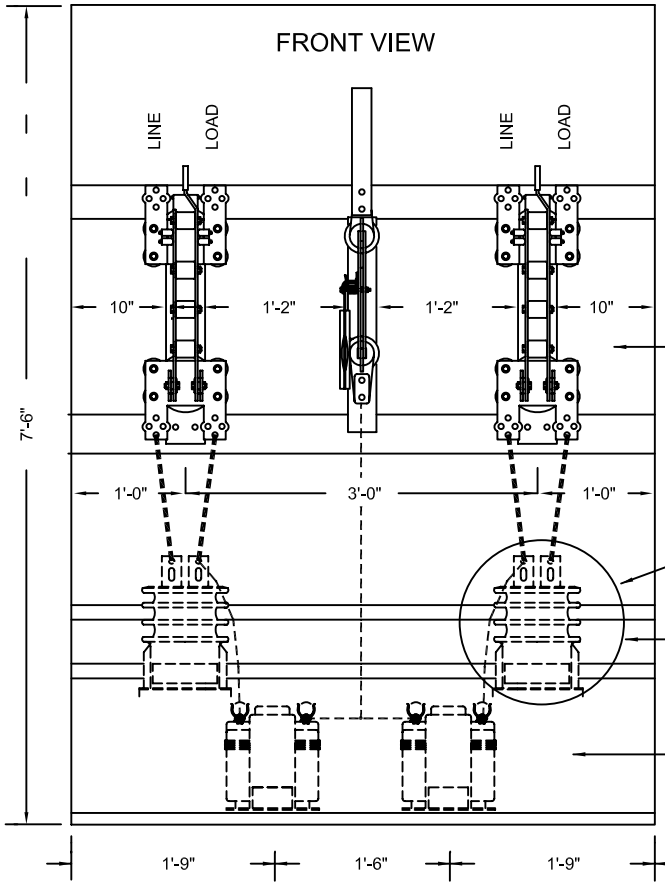
OR SIMILAR WITH THE APPROVAL OF LOUISVILLE GAS & ELECTRIC CO.
FURNISHED AND INSTALLED BY CUSTOMER

SWITCHES TO BE FURNISHED & INSTALLED BY: CUSTOMER.

THREE LINE DIAGRAM



FRONT VIEW



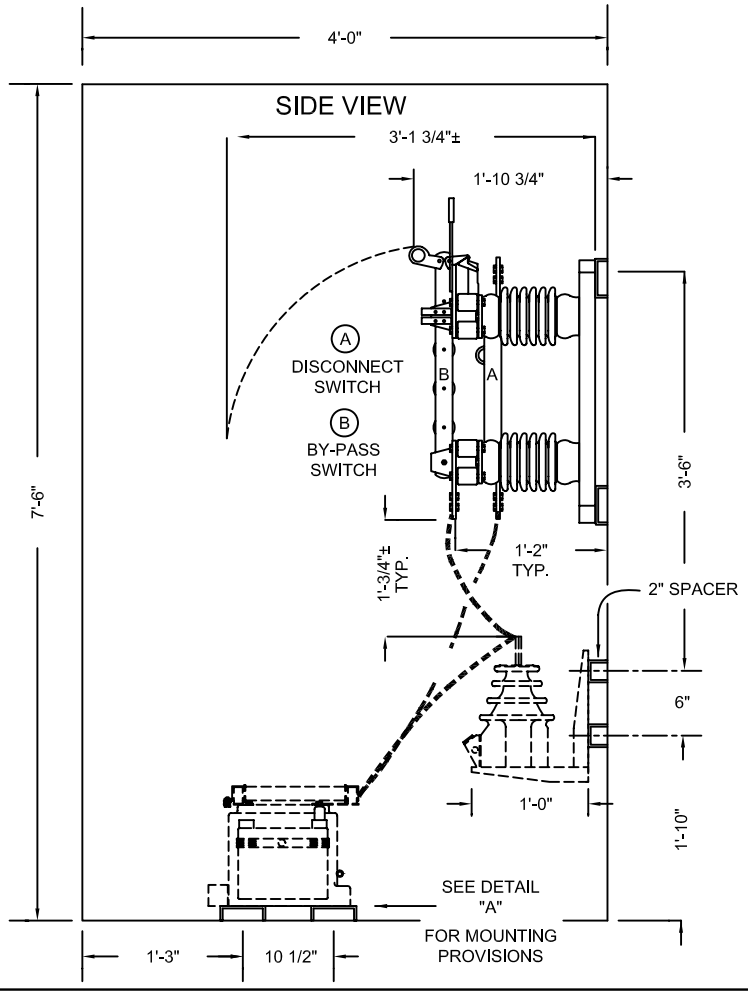
600 AMP MAXIMUM DISCONNECT SWITCHES AND BY-PASS SWITCHES FURNISHED BY CUSTOMER.

SEE DETAIL "B" FOR MOUNTING PROVISIONS

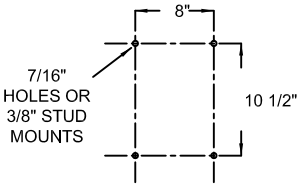
(2) CURRENT TRANSFORMERS & MOUNTING BRACKETS BY: L.G.&E. CO.

(2) POTENTIAL TRANSFORMERS BY: L.G.&E. CO.

SIDE VIEW



DETAIL "A"

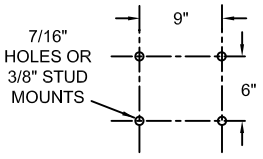


BOLT PATTERN FOR MOUNTING P.T.

MOUNTING PROVISIONS FURNISHED BY CUSTOMER.

P.T.'S FURNISHED BY L.G.&E.

DETAIL "B"



6" X 9" BOLT PATTERN FOR MOUNTING C.T. BRACKETS.

MOUNTING PROVISIONS FURNISHED BY CUSTOMER.

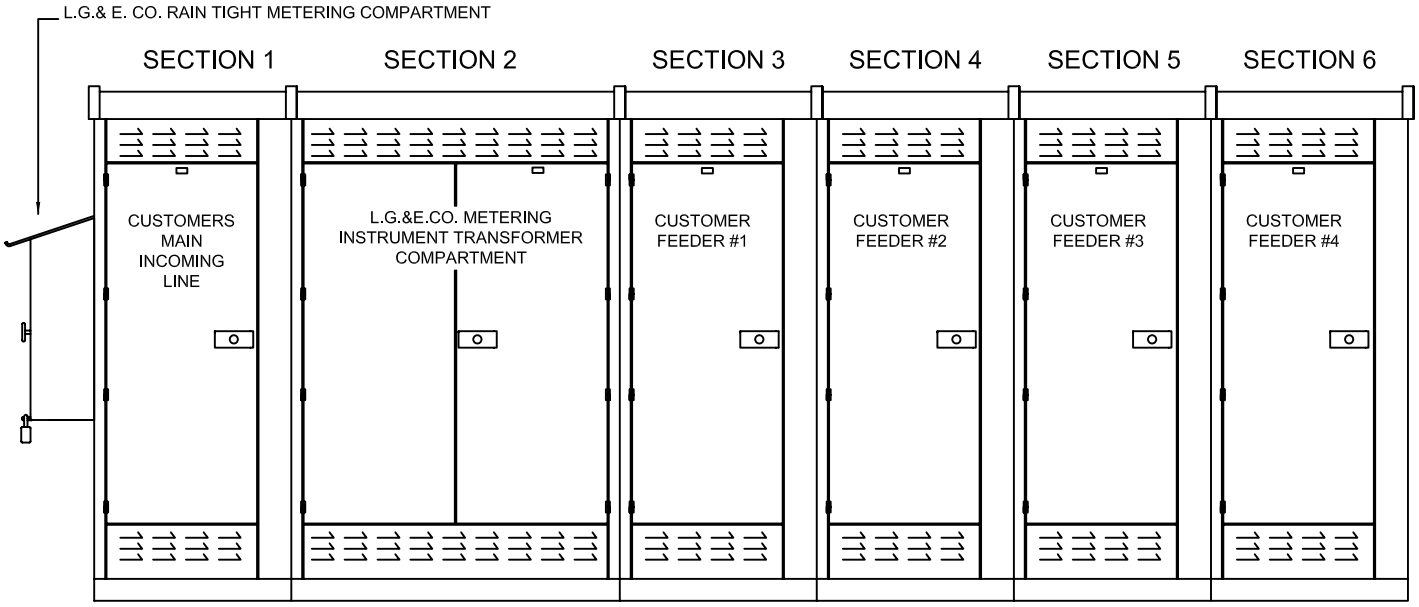
MOUNTING BRACKET AND C.T.'S FURNISHED BY L.G.&E.

GENERAL: THIS STANDARD DETAILS A 13.8KV PRIMARY METERING CUBICLE FOR CUSTOMER OWNED SWITCHGEAR

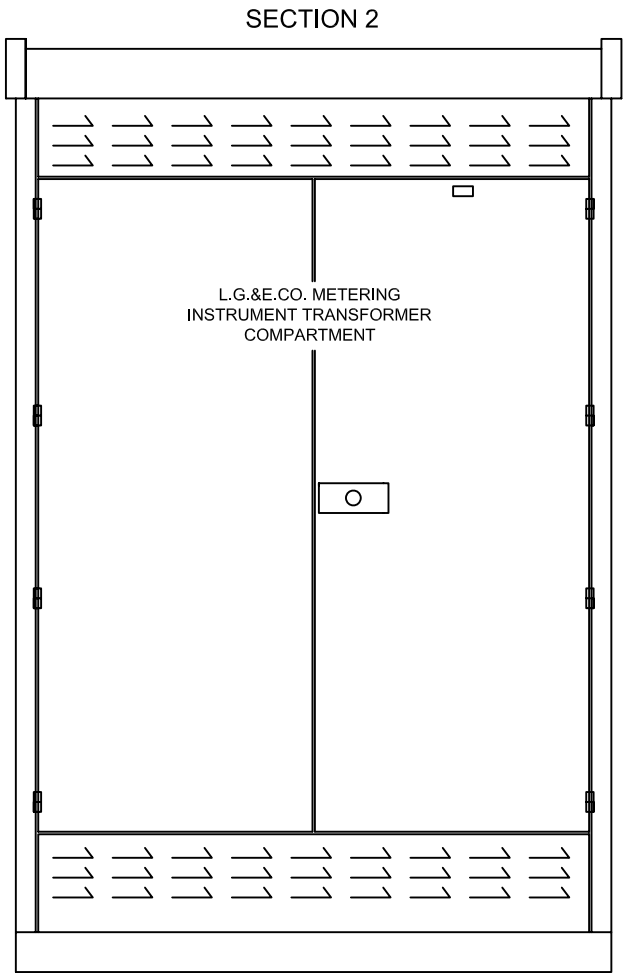
13.8KV PRIMARY METERING CUBICLE FOR CUSTOMER OWNED SWITCHGEAR		
SCALE NONE	81 10 36	SHEET 1 OF 2

REVISION	REPLACES DRAWING	DATE	DRAWN BY
	NONE	10/27/94	CLARK/LEAKE

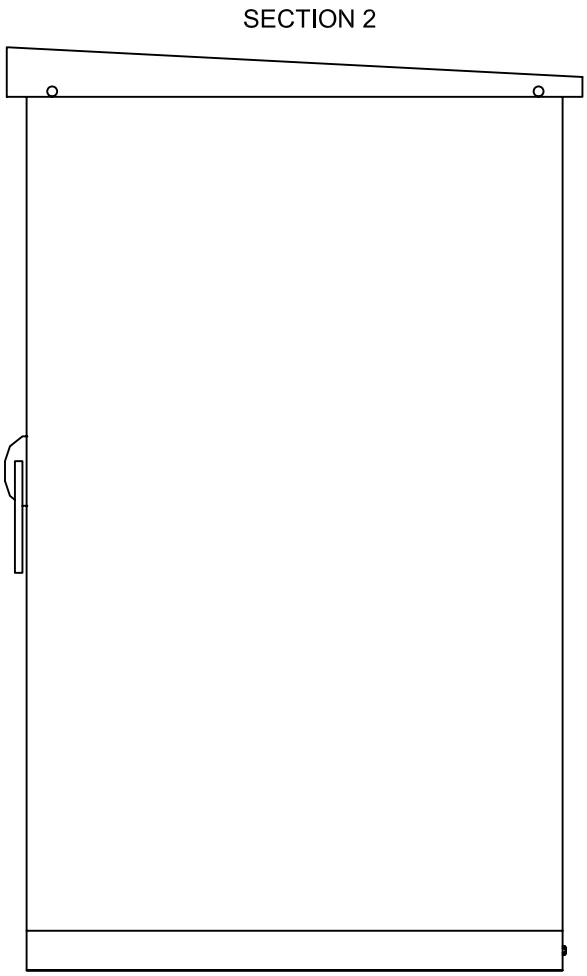
LOUISVILLE GAS & ELECTRIC COMPANY
ET&D OVERHEAD & UNDERGROUND LINE DESIGN & CONSTRUCTION MANUAL



CUSTOMER FURNISHED SWITCHING AND METERING CUBICLES
TYPICAL CONFIGURATION



FRONT VIEW



SIDE VIEW

LOUISVILLE GAS & ELECTRIC COMPANY

ET&D OVERHEAD & UNDERGROUND LINE DESIGN & CONSTRUCTION MANUAL

DRAWN BY	CLARK/LEAKE
DATE	10/27/94
REPLACES DRAWING	NONE
REVISION	

13.8KV PRIMARY METERING CUBICLE FOR CUSTOMER OWNED SWITCHGEAR

SHEET	81 10 36	SCALE
2 OF 2		NONE

GENERAL: THIS STANDARD DETAILS A 13.8KV PRIMARY METERING CUBICLE FOR CUSTOMER OWNED SWITCHGEAR

DIVISION 26 – ELECTRICAL

SECTION 260300 - MEDIUM VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Division 26 Basic Materials and Methods sections apply to work specified in this section.

PART 2 - POWER DISTRIBUTION TRANSFORMERS:

2.1 Pad mount transformer shall be liquid filled, concrete pad mounted and completely enclosed with high voltage switching and removable oil fusing and shall be dead front type with bushing wells and inserts. Transformer shall conform to the requirements of the local authority having jurisdiction for distance from the building. Verify these clearances and restrictions prior to pouring concrete pads and roughing in any work.

2.2 Performance Requirements:

2.2.1 Built to ANSI Standard C57.12.00 - 1968. ANSI short circuit test (Sample Unit) data, ANSI impulse test - full and chopped wave (Sample Unit) data and certified test data (ANSI) (Sample Unit).

2.2.2 KVA size - As noted on the drawings.

2.2.3 Primary Voltage - As noted on the drawings.

2.2.4 Secondary Voltage - The low voltage neutral shall be brought out through a fully insulated bushing in the secondary compartment and grounded externally. Refer to Drawings.

2.2.5 60 Hertz frequency.

2.2.6 Temperature rise above ambient shall not exceed 65°C.

2.2.7 High conductivity aluminum coils.

2.2.8 Two winding transformer - 3 coils.

2.2.9 Provide minimum of two sets of + or - 2/1/2% taps with external handle for de-energized operation.

2.2.10 Impedance - not less than 5% and not more than 7%.

2.2.11 Noise level - not to exceed NEMA Standard levels.

2.2.12 Bolted connection will be acceptable only from lead to bushing. All other connections shall be welded or adequately crimped.

2.2.13 Provide with dead-front distribution class MOV lightning arrestors, arranged to suit the provided voltage and bushings on the primary side.

2.2.14 Must be liquid filled and have a bolted tank cover. Liquid shall be non-flammable and shall be U.L. listed silicone or R-Temp. Transformers shall be manufactured, equipped, and installed to conform to the U.L. classification of the liquid.

2.2.15 Indoor pad-mounted transformer shall be protected by three bay-o-net oil-immersed expulsion fuses, load-break with fault sensing elements in series with parallel partial range oil-immersed current limiting fuses, primary current sized for the full secondary load amperes. Fuses shall be interlocked to 3-phase dead front, 300A loadbreak oil switch.

2.2.16 Indoor pad-mounted transformers shall be furnished with a hotstick operable three-phase, load-break primary voltage oil-immersed, 300 ampere 4-position T-blade sectionalizing switch to disconnect loop circuit.

2.2.17 Provide test: Completely assembled tank with all accessories in place (except for pressure relief valve) must withstand a test pressure of 12 PSI.

2.2.18 Shall be loop feed-thru type with six two piece bushing wells with 300 amp inserts, arranged to include M.O.V. lightning arrestors.

2.2.19 Internal leads shall be of sufficient length to permit field replacement of bushing without opening the tank.

2.2.20 Transformer paint color shall be Munsell Green #7GY3.29/1.5, or custom color if required elsewhere in these documents.

2.2.21 Accessories For Each Unit:

Cooling fans as required by manufacturer
Liquid level gauge
Vacuum pressure gauge and valve
Drain valve with a built-in sampling device
Upper filling plug
Pressure-relief valve
Welded steel tank
Lifting lugs, skiddable in all directions
Dial type temperature gauge
Threaded grounding lug
Warranty period - 2 year, unconditional from date of installation acceptance by the Engineer or Owner.
Permanent nameplate data submitted before shipment to site.
Hot Stick
Provide with six spare high voltage splice kits and all necessary accessories to remove one transformer while leaving the other operational. Provide cabinet for housing kits and accessories as shown on drawings.

PART 3 - INSTALLATION OF TRANSFORMERS

3 Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA and IEEE standards, and in accordance with recognized industry practices and ensure that products fulfill requirements.

3.1 Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

3.2 Install units on vibration mounts as shown; comply with manufacturer's indicated installation method.

3.3 Connect transformer units to electrical wiring system; comply with requirements of other Division 26 sections. Wiring connections to be in strict conformity with N.E.C.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260400 - ELECTRICAL DISTRIBUTION EQUIPMENT

PART 1 - MAIN SWITCHBOARD - CIRCUIT BREAKER STYLE:

1.1 Switchboard shall be dead front, totally enclosed, free standing type consisting of sections housing the equipment as indicated. The structure height shall be 92" high including the base channels. The structure shall be constructed of formed steel channels and angles, 12 gauge minimum to support cover plates, bussing, distribution equipment and other devices to be installed therein. Removable cover plates shall be provided on all sides and top with opening for conduit in bottom. Cover plates and trim shall have formed edges so that no sheared surfaces are exposed. Housing shall be given a rust inhibiting treatment inside and out and finished in blue gray baked enamel. Connection will be made by entering the switchboard as indicated on the drawings. The switchboard shall meet UL 891 and UL 489 standards, and be furnished with an Underwriters' Laboratories label.

1.2 Each switchboard section shall have an open bottom (closed for wall-mounted style) and a top plate for installation and termination of conduit. Top and bottom conduit areas are to be clearly shown and dimensioned on the shop drawings. The wireway front covers shall be secured by screws and hinged, to permit access to the branch circuit breaker load side terminals. The paint finish shall be medium light gray, per ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment. Enclosure shall be NEMA 1, with drip shield on top. Provide top covers without knockouts. All conduit entries to be field cut. At top conduit entries, provide weatherproof sealing lock nuts on terminator. All unused positions shall have closures.

1.3 All bussing including ground bus shall be solid copper. The temperature rise above ambient of the bus bars shall not exceed 65 degrees C. Heat rise test shall be conducted in accordance with U.L. Standard UL-67. All joints are to be rigidly bolted to insure maximum conductivity. All bus bars shall extend full length of equipment to permit future additions.

1.4 The main bus shall be adequately braced to withstand short circuits of 100,000 asymmetric RMS amperes. The line side of branch units shall be bussed with copper connectors unless otherwise indicated or required. All units shall have lockout provisions.

1.5 Neutral and ground shall be separate busses. Neutral bussing shall be of the same ampacity bussing and insulated from the enclosure. Ground bussing shall be sized and shall be bonded to the enclosure per NEC, current edition. Service grounding electrode connection shall be made between ground and neutral busses. Provide ground bushings and equipment ground conductor connection on each feeder conduit leaving switchboard and at the terminal end for each continuous metallic feeder conduit.

1.6 The main section shall house a 100% rated, solid-state, electronic trip circuit breaker. Ground fault protection shall be provided as required by NEC Article 230-95, where switchboard is rated for 277/480 volts and circuit breaker frame sizes are 1000 amperes or greater, regardless of trip setting.

1.7 Distribution section shall consist of the number of circuit breakers of sizes as indicated. Units shall be mounted in group type construction and supplied as indicated.

1.8 Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate as well as exercise the circuit breaker operating mechanisms.

1.9 Each switchboard, as a complete unit, shall be given a single short circuit current rating by the manufacturer. Such a rating shall be established by actual tests by the manufacturer, in accordance with UL specifications, on equipment constructed similarly to the subject switchboard.

1.10 Provide concrete housekeeping pad, 3" high, with #4 rebar on 6" X 6" centers, per ACI standards. Chamfer edges of pad ½".

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

2.1 Panel board 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 panel board interior assembly shall be dead front with panel board 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 Panel board bus structure and main lugs or main breaker shall have current ratings as shown on the panel board 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 panel boards 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 panel boards shall be capable of accepting 225 amp 3 pole branch breakers as a minimum unless otherwise noted.

2.5 Each panel board, 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 over current devices mounted in the panel board. The short circuit tests on the over current devices and on the panel board structure shall be made simultaneously by connecting the fault to each over current device with the panel board 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 panel board short circuit current or greater. Testing of panel board over current 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. Panel boards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

PART 3 - BRANCH PANELBOARDS

3.1 This section covers lighting and power panel boards

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

3.3 Branch panel boards shall be as indicated on the drawings and as specified herein. The lighting panel boards shall be of the dead-front, quick-make, quick-break, bolt-on 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.

3.4 The panel boards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Provide baked-on grey enamel finish, in accord with

ANSI 61. Panels shall be constructed in accord with Federal Specification W-P-115B Type 1 Class 1, UL67, UL50, NEMA P31, and NFPA 70. Locks shall all be keyed alike.

3.5 Each door shall have a directory card inside, covered with a plastic shield, filled in 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.

3.6 Panel board trim for surface or flush panels shall be double-hinged type, to allow exposure of dead-front breaker portion behind locked door, with screw-fastened gutter trim that is hinged to allow full access to wiring gutters.

3.7 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.

3.8 Branch panel boards shall be surface or flush mounted as indicated on the Contract Drawings. Flush panels trims shall be tight to wall and interior barriers, with no gaps allowing access to live parts. Oversize trims will not be acceptable.

3.9 Note: Where mounted in groups, align top of trim or tub for all panels in an area. Exact mounting height of top line shall be as directed by the Engineer.

3.10 Circuit breakers shall be molded-case construction, per U.L. 489, Federal Specifications W-C-375B/GEN MCCB, NEMA AB1. 208V circuit breakers shall be of 10,000 A.I.C. RMS symmetrical rating. 480V circuit breakers shall be 18,000 A.I.C. RMS symmetrical rating unless otherwise indicated on the Contract Drawings or required by fault current capacity. Verify with study prior to ordering. Distribution panels shall have 42K A.I.C. or 35K A.I.C. breakers as required.

3.11 All main bus and connections thereto in branch panel boards shall be copper. All bus bars shall extend full length of panel boards.

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

3.13 All panel boards shall have full size uninsulated copper ground busses, insulated full neutral busses.

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.

PART 6 – FUSES:

6.1 Upon completion of the building, the Contractor shall provide the owner with spare fuses as shown below.

6.1.1 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as 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 HI-CAP TIME DELAY FUSES. 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 LOW-PEAK Dual Element Fuses,. 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 LOW PEAK DUAL-ELEMENT FUSEs. 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 HI-CAP Time Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by LOW-PEAK Dual-Element Fuses 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 LOW-PEAK Dual Element fuses. The fuses shall be UL Class RK1.

PART 7 - DISTRIBUTION TRANSFORMERS:

7.1 Three phase transformers are to have 480 volt Delta primary and 120/208V/3Ø/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.

7.2 Copper-wound, 3-phase, common core, ventilated, dry-type isolation transformer built to NEMA ST20 and relevant NEMA, UL and IEEE standard; 60 Hz rated; insulation & Varnish Systems: 220 degree C class; Epoxy Polyester impregnation; Transformers 750 kVA and less, 600 volt primary and less, shall be UL and bear the label. All terminals, including those for changing taps, must be readily accessible by removing a front coverplate. Windings shall be continuous copper wire with terminations brazed or welded. 10kV BIL.

7.3 Operating Temperature Rise shall be 130 degree C in a 40 degree C maximum ambient.

7.4 Noise levels per NEMA ST-20, demonstrate compliance by providing factory production test report for each unit on this project upon shipment.

7.5 Impedance shall be between 3.5% and 5.8% unless otherwise noted.

7.6 Zero sequence impedance/reactance; Less than 0.95% and 0.3% respectively.

7.7 Exceed NEMA TP-1 Efficiency Requirements per NEMA TP-2 test.

7.8 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. No splicing acceptable. Materials incorporated must have at least a minimum of one year of proven field usage, accelerated laboratory tests not acceptable in lieu of this field usage. Insulation systems shall be listed by Underwriters Laboratories.

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

7.10 All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. Cores for transformers greater than 500kVA shall be clamped utilizing insulated bolts through the core laminations to ensure proper pressure throughout the length of the core.

7.11 The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.

7.12 Transformers 15 KVA thru 75 KVA shall be provided with interchangeable mounting for floor or wall.

7.13 The maximum top of case temperature shall not exceed 50ºC above 40ºC ambient.

7.14 The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with baked enamel. Air dry finishes will not be accepted as being equivalent.

7.15 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.

7.16 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.

END OF SECTION.

DIVISION 26 – ELECTRICAL

SECTION 260500 - LIGHTING

PART 1 - GENERAL

3.1 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.

3.2 All items furnished shall comply with the latest standards applicable such as UL, 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.

3.3 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 review 30 days after bid date. (Verify shop drawing quantities with the Architect.)

3.4 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. All suspended fixtures shall be mounted square and plumb.

3.5 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.

3.6 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.

3.7 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.

3.8 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.

3.9 Refer to architectural details as applicable for recessed soffitt 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.

3.10 Pre-manufactured or built to suit flexible wiring systems are not permitted for this project.

PART 2 – BALLASTS

2.1 Fluorescent ballast shall be NEMA Premium, programmed start, high performance electronic to operate at a frequency of 40KHz 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 0.88 ballast factor, power factor greater than 0.98. 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 1.5 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, and shall be rapid start.

2.2 Ballast shall have less than 10% total harmonic distortion with less than 6% third harmonic distortion. Ballast shall have "A" sound rating with a power factor greater than .99 and have a twenty year rated life. Ballast shall contain auto restart circuitry in order to restart lamps without resetting power. Ballasts used shall operate 1, 2, 3 or 4 T8 lamps as specified in the fixture schedule. Use ballast to match number of lamps in fixture, and meet all switching requirements as shown on the drawings. Ballasts shall be unconditionally warranted by the manufacturer for a period of five years from project beneficial occupancy.

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

2.4 High Intensity Discharge (HID) ballasts shall be Pulse Start complete with external fuse holder. All HID 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 HID 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.

2.5 Lighting standards shall 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 3 – LAMPS

3.1 T8 fluorescent lamps shall be high performance type, 1" diameter, various lengths, wattages, with 3100 initial lumens and 2915 design lumens at 25º Celsius for 48" lamps with a color rendering index (CRI) of 82 or higher, medium bi-pin base configuration. Normal color to be 4100º Kelvin unless specified otherwise on fixture schedule. Normal power input to be 32 watts for 48" lamps. Lamps shall have an average life of 40,000 hours at three hours per start on a programmed start ballast. Lamps shall be green cap, low mercury type..

3.2 T5 fluorescent lamps shall be 5/8 inch diameter, various lengths, wattages, with 3050 initial lumens and 2835 design lumens at 35º Celsius for 48" lamps with a color rendering index (C.R.I.) of 85 or higher, medium bi-pin base configuration. Normal color to be 4100º Kelvin unless specified otherwise on fixture schedule. Normal power input to be 28 watts for 48" lamps. Lamps to have an average life of 30,000 hours at three hours per start on a programmed start ballast. Lamps shall be green cap, low mercury type.

3.3 T5HO fluorescent lamps shall be amalgam (wide temperature range) type, 5/8 inch diameter, various lengths, wattages, with 4900 initial lumens and 4560 design lumens at 25/35º Celsius for 48" lamps with a color rendering index (CRI) of 85 or higher, medium bi-pin base configuration. Normal color to be 4100º Kelvin unless specified otherwise on fixture schedule. Normal power input to be 54 watts for 48" lamps. Lamps to have an average life of 25,000 hours at three hours per start on a programmed start ballast. Lamps shall be green cap, low mercury type. .

3.4 HID (high pressure sodium, 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. HID lamps used in outdoor fixtures shall have clear envelopes, in indoor fixtures they shall have diffuse coatings unless specifically indicated otherwise.

3.4.1 Metal halide lamps shall be Sylvania "Super Metalarc" 4100° Kelvin correlated color temperature (CCT). 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 CRI. Clear lamps shall be 60 CRI minimum, coated lamps shall be 70 CRI minimum.

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

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	Average Constant Light Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Multipurpose Field	30 footcandles	3.0:1.0	50	30’ x 30’

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	Average Initial Light Levels	Average Constant Light Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Multipurpose Field	43 footcandles	30 footcandles	3.0:1.0	50	30’ x 30’

For alternate systems, scans 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

70’ for pole S1

40’ for poles S2 and S3.

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

1.3 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.

Area of Lighting	Grid Point Interval Spacing	Maximum Horizontal Footcandles	Average Horizontal Footcandles
150’ from Multipurpose Field in any direction	30’	.8 footcandles	.30 footcandles

Area of Lighting	Grid Point Interval Spacing	Maximum Vertical Footcandles	Average Vertical Footcandles
Herman & Heady Kurz Hall	20’	1.5 footcandles	1.2 footcandles

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

2.1.2 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.

2.1.3 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.

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

2.1.5 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.

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

2.1.7 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.

2.1.8 Service Platforms – **Pole S1 Only**. 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.

2.1.9 Pole Climbing Steps, Safety Cable and Safety Harness – **Pole S1 Only.** 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.

2.1.10 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.

2.1.11 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.

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

2.1.13 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 262300 - EMERGENCY GENERATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections apply to work of this section.

1.1.2 Division 26 Basic Materials and Methods sections apply to work specified in this section.

PART 2 - DESCRIPTION OF WORK:

2.1 Extent of standby generator system work is indicated by drawings and schedules.

2.2 Types of standby generator system equipment required for project include the following:

2.2.1 Turbo-charged engine driven generators.

2.2.2 Automatic Transfer Switches, Batteries and Chargers.

PART 3 - QUALITY ASSURANCE:

3.1 General Requirements: It is the intent of this specification to secure an emergency generator system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All equipment shall be new, of current productions of a national firm. The standby generator set(s) including generator, controls, and transfer switch(es), shall be assembled as a matched unit so that there is a one-source responsibility for warranty, parts, and service without a local representative with factory-trained servicemen.

3.2 Manufacturers: Firms regularly engaged in manufacture of engine driven standby generator systems, of types, ratings and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.

3.3 Installer: Qualified with at least 5 years of successful installation experience on projects with engine generator system installation work similar to that required for project.

3.4 NEC Compliance: Comply with applicable standby generator requirements of NEC including, but not limited to emergency and standby power generating systems, and health care facilities and Articles 230, 517, 700, 701, and 702.

3.5 NFPA Requirements: Comply with applicable requirements of NFPA No. 37, 101, 110 pertaining to stationary combustion engines, institutional facilities and life safety code.

3.6 UL Compliance: Comply with applicable requirements of UL 1008, "Automatic Transfer Switches". Provide standby generator system components, including automatic transfer switches, which are UL listed and labeled with a circuit breaker mounted on the set.

3.7 ANSI/NEMA Compliance: Comply with applicable requirements of ANSI/NEMA MG 1, "Motors and Generators", and MG 2, "Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators". Transfer switches shall comply with ICS 2.

3.8 IEEE Compliance: Comply with applicable portions of IEEE Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to standby power.

PART 5 - PRODUCTS

5.1 EQUIPMENT:

5.1.1 The natural gas driven generator set(s) shall be rated continuous standby (defined as continuous for the duration of any power outage) 277/480 Volts, 3 phase, 4 wire, 0.8 PF, 150 KW, 188 KVA, 225 amperes at 3300 feet altitude, 122 degrees F.

5.1.2 The generator set shall be capable of starting motor loads of 920 KVA inrush, at 90% sustained voltage.

5.2 ENGINE:

5.2.1 The engine shall be governed at a speed of 1800 RPM. The engine shall be equipped with the following:

5.2.1.1 Isochronous governor capable of +/- 0.25% steady-state frequency regulation.

5.2.1.2 24-Volt positive engagement solenoid shift-starting motor.

5.2.1.3 37-Ampere minimum automatic battery charging alternator with solid-state voltage regulation.

5.2.1.4 Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.

5.2.1.5 Dry-type replaceable air cleaner elements for (normal/heavy) duty application.

5.2.1.6 Engines requiring glow plugs will not be acceptable.

5.3 GENERATOR:

5.3.1 The alternator shall be salient-pole, brushless, 12-lead reconnectable, 2/3 pitch, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA Standard (MG1-22.40 and 1 6.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to 125ºC.

5.3.1.1 The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within +/- 2% at any constant load form 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operation; and be protected from the environment by conformal coating.

5.3.1.2 Upon one-step application of any load up to 100% of the rated load at 0.8 power factor, the voltage dip shall not exceed 20% and shall recover to +/- 2% of rated voltage within one second.

5.3.1.3 The generator shall be capable of sustaining at least 300% of rated current for at least 10 seconds under a three-phase symmetrical short by inherent design.

5.3.1.4 A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished which protects the generator from damage due to its own high current capability,. This breaker shall not trip within the 10 seconds specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition. This breaker shall not automatically reset preventing restoration of voltage if maintenance is being performed. Field current-sensing breaker will not be acceptable.

5.3.1.5 The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

5.4 CONTROLLER:

5.4.1 The NEMA 1 enclosed control panel shall be mounted on the generator set with vibration isolators. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. The generator set mounted control shall include the following features and functions:

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

5.4.3 RESET switch: The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

5.4.4 PANEL LAMP switch: Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power.

5.4.5 Generator set AC output metering: The generator set shall be provided with a metering set with the following features and function:

5.4.5.1 Analog AC Voltmerer, dual range 90 degree scale, 2% accuracy; Analog AC Ammeter, dual range, 90 degree scale, 2% accuracy; Analog Frequency/RPM meter, 45-65 Hz, 1350-1950 RPM, 90 degree scale, +/- 0.6 Hz accuracy.

5.4.5.2 Seven position phase selector switch with OFF position to allow meter display of current and voltage in each generator phase. When supplied with reconnectable generators, the meter panel shall be reconnectable for the voltage specified.

5.4.5.3 Generator Set Alarm and Status Display: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing alarm and shutdown conditions. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on the display panel:

Switch off (flashing)
Low oil pressure (alarm)
Low oil pressure (shutdown)
Low coolant temperature (alarm)
High coolant temperature (alarm)
High coolant temperature (shutdown)
Low coolant level (shutdown)
Overcrank (shutdown)
Overspeed (shutdown)
Ground fault (alarm) (optional-when required by code or specified)

5.4.6 In addition, provisions shall be made for indication of two customer-specified alarm or shutdown conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

5.4.7 Engine Status Monitoring: The following devices shall be provided on the generator set control:

Engine oil pressure gauge

Engine coolant temperature gauge
Engine operation hour gauge
Battery voltage (DC volts)

5.4.8 Control Functions: The control system provided shall include a cycle cranking system, which shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods. Fail to start shall be indicated by operation of the overcrank alarm indication lamp.

5.4.9 Alternator Control Functions: The generator set shall include an automatic voltage regulation system which is matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 Hz for 60 Hz machines, and 48-49 Hz for 50 Hz machines.

5.4.10 Voltage adjusting rheostat, locking screwdriver type, to adjust voltage +/- 5% from rated value.

5.5 FACTORY INSTALLED ACCESSORIES: Provide the following factory installed accessories:

5.5.1 Block heater, one 1500-Watt 208 volt AC. Thermostatically controlled and sized to maintain engine coolant at proper temperature to meet the requirements of NFPA-110 Regulation.

5.5.2 Overvoltage protections will shutdown the unit after one second of 15% or more overvoltage. Note: Sensitive equipment may suffer damage in less than one second of an overvoltage condition. On-line equipment requiring faster shutdown should have its own overvoltage protection.

5.5.3 A battery box heater shall be included.

5.5.4 Provide (2) 3-pole, mold case circuit breakers for distribution as required.

5.6 ACCESSORIES: Provide the following accessories:

5.6.1 Battery rack, battery cables, 12-Volt lead - antimony battery(ies) capable of delivering the manufacturer's recommended minimum cold-ranking Amps required at 0 Degrees F. per SAE Standard 7-537, shall be supplied.

5.6.2 10 Ampered automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/- 10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient from -40 degrees C. to + 60 degrees C., 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Alarm circuit shall be included to meet the requirements of NFPA 110 for low battery voltage, high battery voltage, and battery charger malfunction.

5.6.3 Gas-proof, seamless, stainless steel, flexible exhaust bellows with threaded NPT connections. The engine exhaust silencer shall be coated to be temperature and rust resistance with integral condensate drain, rated for critical application. Exhaust noise shall be limited to 85 dBA as measured at 10 feet in a free-field environment.

5.6.4 One (1) remote annunciator shall monitor all controller functions plus line power and generator power monitoring. An integral lamp test and horn silencer switch shall be included, as required to meet NFPA 110. Provide complete installation as required.

5.6.5 Anchor Bolts: Galvanized steel, of types and sizes indicated.

5.6.6 Furnish anchor bolts to concrete formwork Installer with installation drawings and instructions.

5.6.7 Outdoor Weather - Protective Sound Attenuated Housing: Generator set housing shall be provided factory-assembled to generator set base and radiator cowling. Housing shall have an average noise rating of 73 dBa at 7

meters. Housing shall provide ample airflow for generator set operation at rated load in the ambient conditions previously specified. The housing shall have hinged side access doors and rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a two step electrocoating paint process or equal. All surfaces of all metal parts shall be primed and painted. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

5.7 AUTOMATIC TRANSFER SWITCHES:

5.7.1 It is the intent of this specification to secure an automatic transfer switch that has been prototype tested, factory built, productions tested, site tested, together with all accessories necessary or a complete installation as shown on the plans and drawing and specified herein. All equipment shall be new, of current production by a national firm. The automatic transfer switch shall conform to the requirements of NEMA Standards ICS 2-447 and Underwriter's Laboratories UL-1008 and shall be UL listed as follows:

5.7.1.1 For use in emergency systems in accordance with Articles 517 and 700 of the National Electric Code.

5.7.1.2 Rated in Ampered for total system transfer including control of motors, electric-discharge lamps, electric-heating and tungsten-filament lamp load. Switches rated above 400 Amperes shall be suitable for 30% or 400 Amperes tungsten-filament lamp load, whichever is higher.

5.7.1.3 Testing: Certified laboratory test data on a switch of the same design and rating shall be provided to confirm the following switching abilities:

5.7.1.3.1 Overload and endurance per Tables 21.2 and 23.2 of UL-1008 when enclosed according to Paragraph 1.6.

5.7.1.3.2 Temperature rise tests after the overload and endurance tests to confirm the ability of the transfer switches to carry their rated current within the allowable temperature limits of the insulation in contact with current carrying parts.

5.7.1.3.3 No welding of contacts. Transfer switch must be operable to alternate source after the withstand current tests.

5.7.1.3.4 Dielectric tests at 1960 Volts, rms, minimum after the withstand current test.

5.7.1.4 All production units should be subjected to the following factory tests:

5.7.1.4.1 The complete automatic transfer switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

5.7.1.4.2 The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.

5.7.1.5 The control panel shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard 472-1974 (ANSI C37.90a) and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

5.7.1.6 The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of over current protection, voltage and X-R ratio.

5.7.1.7 The automatic transfer switch shall consist of a power transfer module and a control module, interconnected to provide complete automatic operation. The automatic transfer switch shall be mechanically held and electrically operated by a single-solenoid mechanism energized from the source to which the load is to be

transferred. The switch shall be rated for continuous duty and be inherently double throw. The switch shall be mechanically interlocked to ensure only one of two possible positions - normal or emergency. The automatic transfer switch shall be suitable for use with emergency sources such as engine or turbine generator source or another utility source.

5.7.1.8 The control module shall be supplied with a protective cover and be mounted separately from the transfer switch for ease of maintenance. Sensing and control logic shall be solid state and mounted on plug-in printed circuit boards. Printed circuit boards shall be keyed to prevent incorrect installation. Interfacing relays shall be industrial control grade, plug-in type with dust covers and locking clips. The following shall also be provided for the control module.

5.7.1.8.1 For single phase switches, the normal source voltage across live lines shall be monitored, and for three phase switches all phases of the normal shall be monitored line-to-line. Close differential voltage sensing shall be provided on all phases. The pickup voltage shall be adjustable from 72% to 100% of nominal and the dropout voltage shall be adjustable from 72% to 98% of the pickup value. The transfer to emergency will be initiated upon reduction of normal source to 85% of nominal voltage and retransfer to normal shall occur when normal source restores to 95% of nominal.

5.7.1.8.2 Neutral conductor terminal lugs as required for the system.

5.7.1.8.3 All movable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks. Automatic operation of the switch shall not required power from any source other than the line-to-line voltage of the source to which the switch is transferring.

5.7.1.9 Each automatic transfer switch shall include the following standard accessories.

5.7.1.9.1 (TDNE) Time delay on transfer from Normal to Emergency (adjustable 0 to 60 seconds).

5.7.1.9.2 (TDES) Time delay on Engine Starting (factory set at 3 seconds).

5.7.1.9.3 (TDEN) Time delay on transfer from Emergency to Normal adjustable 0-30 minutes).

5.7.1.9.4 (TDEC) Time delay on engine cool-off.

5.7.1.9.5 Four position selector switch with white light. Permits four modes of switch operation -- TEST, AUTO, OFF, and ENGINE START.

5.7.1.9.6 Frequency/voltage relay for emergency source.

5.7.1.9.7 Disconnect plug on wiring harness to disconnect switch control logic.

5.7.1.9.8 Main shaft auxiliary contact rated 10 ampere at 480V (one closed on normal and one closed on emergency).

5.7.1.9.9 Green lamp to indicate switch in normal position and normal power is supplying loads.

5.7.1.9.10 Red lamp to indicate switch in emergency position and emergency power is supplying loads.

5.7.1.9.11 Provide switches with programmed transition. Switch shall be capable of manual transfer under full load.

5.7.1.9.12 Automatic exerciser.

PART 6 - EXECUTION

6.1 INSTALLATION OF ENGINE GENERATOR SYSTEMS:

6.1.1 Install standby engine generator sets as indicated, in accordance with the equipment manufacturer's written instructions, and with recognized industry practices, to ensure that engine generator sets fulfill requirements. Comply with NFPA and NEMA standards pertaining to installation of standby engine generator systems and accessories.

6.1.2 Coordinate with other work, piping and accessories, as necessary to interface installation of standby generator system work with other work.

6.1.3 Install units on vibration isolators in accordance with Division-20 section; comply with manufacturer's indicated installation method if any.

6.1.4 Connect gas piping to standby generator equipment as indicated, and comply with manufacturer's instructions where not otherwise indicated.

6.1.5 Align shafts of engine and generator within tolerances recommended by equipment manufacturer.

6.2 GROUNDING:

6.2.1 Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for system components as indicated.

6.3 TESTING:

6.3.1 Manufacturer shall provide a factory trained service engineer to supervise entire testing procedure.

6.3.2 Upon completion of installation of engine generator system and after building circuitry has been energized with normal power source, test engine generator to demonstrate standby capability and compliance with requirements. Where possible, field correct malfunctioning units, then retest to demonstrate compliance; otherwise, replace defective components and proceed with retesting.

6.3.3 Run generator under full load for a minimum of 2 hours and record results. Generator shall be capable of delivering full capacity while operating in an ambient temp. of 122 degrees F. Factory test data showing run-test loads is not acceptable. Resistive load tank shall be furnished and connected to the generator to achieve a full load per generator capacity. Generator shall be capable of delivering full capacity while operating in an ambient temperature of 122 degrees F. Factory test data showing run-test loads is not acceptable.

6.3.4 Record Fuel consumption, coolant temperature, lube oil pressure, output voltage (each phase), output current (each phase), room temperature at 15 minute intervals.

6.3.5 Verify motor starting ability by use of largest connected motor and the load bank.

6.3.6 Upon completion of the generator load test, the emergency light and power system shall be operated on generator power under actual load conditions connected within the facility. Test shall be run for a minimum of two (2) hours.

6.3.7 The complete automatic transfer switch shall be tested as to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

6.4 TRAINING OF OWNER'S PERSONNEL:

6.4.1 Provide services of manufacturer's technical representative for 4-hours to instruct Owner's personnel in operation and maintenance of the engine generator system.

6.4.2 Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date. Obtain receipt that training has been accomplished.

6.5 5-YEAR COMPREHENSIVE WARRANTY:

6.5.1 For standby power applications only, the complete electrical power system (generator set, controls, transfer switches, accessories, etc.), as provided by the single-source manufacturer, shall be warranted by said manufacturer against defects in materials and workmanship for a period of five years or 1500 hours, whichever occurs first from the date of system start-up. Said coverage shall include parts, labor, travel expenses, and labor to remove/reinstall said equipment. This shall be all inclusive and not per the manufacturer's standard published limited warranty. There shall be no deductibles applied to said warranty. A statement to acknowledge this shall be included within the submitted shop drawings from the local sales office/vendor.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 264313 - SURGE SUPPRESSION DEVICES

PART 1 - GENERAL

1.1 This section describes the materials and installation requirements for Surge Protective Devices (SPDs), formerly TVSS, for the protection of AC electrical circuits.

1.2 Each Contractor's attention is directed to Section 16000, General Provisions-Electrical and all other contract documents as they may apply to their work.

PART 2 – SCOPE OF THE WORK

2.1 The Contractor shall provide the necessary labor, materials, wiring and services necessary to provide the complete electrical surge protection systems as specified herein. This work shall include, but is not necessarily limited to:

2.2 Provision of Surge Suppression Units at certain points in the power distribution network and on telephone and television service lines.

2.3 Proper installation of surge suppression unit(s), in accord with shop drawings. Wiring routing, grounding and all connections shall be in exact accord with manufacturer's recommendations.

PART 3 – QUALITY ASSURANCE

3.1 STANDARDS – Most Recent Edition of

1. Underwriters Laboratories: UL1449, 3RD Edition
2. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002
3. National Electrical Code: Article 285

3.2 Manufacturer shall be regularly engaged in production of surge protection equipment of types, sizes and ratings required, whose products have been satisfactorily used in similar service for not less than three years.

3.3 LISTING REQUIRMENTS: Comply with NEC and NFPA requirements, as applicable to materials and installation of surge protection components and wiring. Surge protection equipment shall be UL listed and labeled for its intended use. "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification. Where applicable, equipment shall comply with ANSI standards for such equipment. All equipment shall be tested per IEEE testing standards listed in this section.

3.4 SPECIAL NOTE: The physical routing, length, and connections of the unit's phase, neutral and ground conductors are critical to the performance of surge suppression units. All wiring shall be installed by the manufacturer prior to shipping equipment and shall not exceed three feet of length.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 269950 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 Section includes commissioning process requirements for Electrical systems, assemblies, and equipment.

1.2.2 Related Sections:

1.2.2.1 Division 1 Section 010800 "General Commissioning Requirements" for general commissioning process requirements.

1.2.2.2 Division 26 Sections for Electrical equipment, systems, and control requirements.

1.2.3 TO FOLLOW WITH COMMISSIONING AUTHORITY'S GUIDANCE

END OF SECTION

DIVISION 27 - COMMUNICATIONS

SECTION 270100 - VOICE AND DATA SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

1.2.1 This Section includes the components, cable, connecting devices, installation, and testing for low voltage structured cabling systems to be used as signal pathways for voice, high-speed data and video transmission.

1.3 DEFINITIONS

1.3.1 EMI: Electromagnetic interference.

1.3.2 IDC: Insulation displacement connector.

1.3.3 LAN: Local area network.

1.3.4 PVC: Polyvinyl chloride.

1.3.5 STP: Shielded twisted pair.

1.3.6 UTP: Unshielded twisted pair.

1.4 PRODUCTS

1.4.1 MOUNTING ELEMENTS

1.4.2 Raceways and Boxes: Comply with Division 26 Section "Raceways and Fittings."

1.4.3 Backboards: 3/4-inch (19-mm) interior-grade, fire-resistive-treated plywood.

1.4.4 UPS units: Provide one (1) unit per communications room per specifications.

1.5 SUBMITTALS

1.5.1 General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

1.5.2 Product Data for each component specified, including detailed manufacturer's specifications. Include data on features, ratings, and performance. Include dimensioned plan and elevation views of components.

1.5.3 Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Provide evidence of applicable registration or certification.

1.5.4 Field test and observation reports from a qualified independent inspecting and testing agency indicating and interpreting test results relative to compliance with performance requirements of the installed systems.

1.5.5 Maintenance data for products to include in the operation and maintenance manual specified in Division 1.

1.5.6 Final schedule of cables as specified in Part 3.

1.5.7 Evidence of listing of products specified to be listed in the "Quality Assurance" Article.

1.5.8 Provide a hard copy of final comprehensive schedules for the Project in the software and format selected by Owner.

1.6 QUALITY ASSURANCE

1.6.1 Installer Qualifications: Engage an experienced Installer who has a registered communications distribution designer (RCDD) as permanent staff, certified by the Building Industry Consulting Service International (BICSI). At least 50% of the employees installing all aspects the low voltage structured cabling system must have current BICSI certification of Installer Level 1 or above.

1.6.2 Manufacturer Qualifications: Engage firms experienced in manufacturing components listed and labeled under EIA/TIA-568 and who comply with these Specifications.

1.6.3 Comply with NFPA 70.

1.6.4 Comply with ANSI American National Standards Institute

1.6.5 Comply with BICSI Building Industry Consulting Service International

1.6.6 Comply with Telecommunications Distribution Methods Manual (current edition)

1.6.7 Comply with Building Officials and Code BOCA Administrators (Standard Building Code)

1.6.8 Comply with EIA Electronic Industries Association

1.6.9 Comply with FCC Federal Communications Commission

1.6.10 Comply with International Conference of ICBO Building Officials (Uniform Building Code)

1.6.11 Comply with IEEE Institute of Electrical and Electronic Engineers, Inc.

1.6.12 Comply with NBC National Building Code

1.6.13 Comply with NFPA National Fire Protection Association

1.6.14 Comply with TIA Telecommunications Industry Association

1.6.15 Comply with University Information Technology Communication Services Communications Standards

1.6.16 Work Coordination: Coordinate Work of this Section with the University's Information Technology Communication Services department. Coordinate the service entrance arrangement with the Owner or its designee.

1.6.17 Meet jointly bi-weekly with representatives of the above organizations and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.

1.6.18 Record agreements reached in meetings and distribute record to other participants.

1.6.19 Adjust the arrangements and locations of distribution frames, patch panels, and cross connects in equipment rooms and wiring closets to accommodate and optimize the arrangement and space requirements of the telephone, and data equipment.

PART 2 – SCOPE OF WORK

2.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

2.2 Cable:

Belden Wire & Cable Company.
Berk-Tek, Inc.
General Cable.
Superior/Essex
Mohawk/CDT.
Siecor Corp.
Minuteman

2.3 Terminal and Connector Components and Distribution Cabinets: Siemens, Leviton Mfg. Co., Inc.; Telcom Division, Chatsworth or Multilink.

2.4 Outlets

2.4.1 **Leviton QuickPort part number 41080-2WP (No Substitute) white single-gang faceplates. Bottom port to be occupied with red jack part number Leviton 61110-RR6 (No Substitute) terminated on data cable. Remaining ports shall be occupied with white Leviton blank inserts or white Leviton F-type bulkhead modules 41804-FIF (No Substitute) where required for CATV video outlets.**

2.4.2 In applications where double-gang faceplates are required, the same pattern as above shall be followed.

2.4.3 Any remaining ports shall be occupied by blank inserts of the same color as the faceplate.

2.4.4 Wall phone outlet(s) shall be terminated on data cable(s) in the same method as above using the same components as above.

PART 3 - SYSTEM REQUIREMENTS

3.1 General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

3.2 Expansion Capability: Unless otherwise indicated, quantity of spare fibers and conductor pairs in cables, positions in patch panels, cross connects, and terminal strips and shall be adequate to accommodate a 50 percent future increase in active workstations.

3.3 Wiring Pathway And Equipment Mounting Elements

3.3.1 All cabling including fiber risers, copper risers, and horizontal voice/data cabling will be terminated on relay racks with vertical and horizontal wire management. The racks and wire management are to consist of the following part numbers (No substitute):

3.3.1.1 **Chatsworth Standard 6"deep rack part number 66353-703;**

3.3.1.2 **CPI MCS Master Cabling section vertical wire management part number 30095-703**

3.3.1.3 **CPI Universal Horizontal Cable Manager part number 30339-719.**

3.3.2 Twisted Pair Cables, Connectors, And Terminal Equipment

3.3.2.1 Listed as Complying with TIA/EIA 568-B.2-1 Category 6: Provide evidence of listing for all products specified in this Article.

3.3.3 Conductors: Solid copper.

3.3.4 Unshielded twisted pair (UTP) Cable: Comply with TIA/EIA 568-B.2-1 Enhanced CAT6. 4 pair No. 24 AWG, tested and rated at 550 megahertz color-coded, all FEP insulated conductors in a plenum rated jacket and blue in color for voice and data installations. Superior Essex part number 54-246-2B **(No Substitute).**

3.3.5 Voice riser cable shall be copper, 24 AWG UTP 50 pair, category 3 minimum. All station and riser cable shall be run through and held in place with D-Rings in telecommunications rooms and/or by use of cable tray. Terminate on 110 type IDC **Leviton part number 41DBR-1F5 (No Substitute) connecting blocks.**

3.3.6 Fiber optic riser cable shall consist of 12 strands each of multi-mode fiber and 12 strands of single mode fiber sheathed each in a single jacket. Superior Essex part number 44024HGC1 **(No Substitute).**

3.3.7 Termination in the MC room SRC123 shall be on standard pullout fiber enclosures, Siemon part number FCP3-DWR with RIC-F-SA601 RIC-F-LC12-01 coupling panels **(No Substitute) utilizing** LC **type connectors.** Separate enclosures for multi-mode fiber and single-mode fiber.

3.3.8 Termination in the TC room SRC212A shall be on standard pullout fiber enclosures; **Siemon part number FCP3-DWR with** RIC-F-LC12-01 **coupling panels (No Substitute) utilizing LC type connectors.** Separate enclosures for multi-mode fiber and single-mode fiber.

3.3.9 Fiber riser shall be installed in riser-rated inner-duct (3/4" I.D. min). Multi-mode and single-mode fiber shall be terminated in separate enclosures.

3.4 UTP Cable Connecting Hardware: Comply with EIA/TIA-568, TSB 40.

3.4.1 Insulation displacement connector (IDC) type, using modules designed for use with punch-down caps or tools.

3.4.1.1 IDC Terminal Block Modules: Integral with connector bodies, including plugs and jacks where indicated.

3.4.1.2 IDC Connecting Hardware: Consistent throughout Project.

3.4.2 STP Cable Connecting Hardware: Comply with EIA/TIA-568, TSB 53 for connectors, plugs, and jack assemblies.

3.4.2.1 Cross-Connect Panel: A modular array of IDC terminal blocks arranged to terminate building riser cables and permit interconnection between cables.

3.4.2.2 Number of Terminals per Field: One for each conductor in assigned cables.

3.4.3 Mounting: Cabinet.

3.4.4 Quickport Panel: A **Leviton part number 49255-H48 (No substitute)** modular panel mounting multiple, numbered jack units terminated to EIA-TIA 568-B standards. Connectors of the IDC type at each jack provide permanent termination of conductor pair groups of installed cables.

3.4.4.1 Number of Jacks per Field: 1 for each 4-pair UTP cable plus spares and spare positions adequate to satisfy specified expansion criteria.

3.4.4.2 Mounting: Cabinet.

3.5 All data terminations at the TC will be terminated on CAT 6 RJ45 jacks and inserted into QuickPort connecting panels mounted on relay cabinets. Where space permits, freestanding cabinets should be installed in the MC and the TC and all terminations should be installed on the cabinets.

3.6 Jacks and Jack Assemblies for UTP Cable: Modular, color coded, CAT 6 RJ45 receptacle units with integral IDC-type terminals. Jacks shall be terminated according to EIA-TIA 568-B standards.

PART 4 - FIBER-OPTIC CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

4.1 CABLES: Factory-fabricated, jacketed, low-loss, glass-type, fiber-optic, multimode, graded index, operating at 850 and 1300 nanometers (nm).

4.1.1 Dimensions: 62.5-micron core diameter, 125-micron cladding diameter.

4.1.2 Minimum Modal Bandwidth: 220 MHz/km at 850 nm; 500 MHz/km at 1300 nm.

4.1.3 Operating Temperature Range: Minus 20 to 70 deg C.

4.2 MAXIMUM END-TO-END ATTENUATION:

4.2.1 Multimode fiber

4.2.1.1 3.50 db @ 220 MHz @ 850 Nm per kilometer

4.2.1.2 1.0 db @ 500 MHz @ 1300 Nm per kilometer

4.2.2 Single mode fiber

4.2.2.1 1.0 db @ 1310 Nm per kilometer

4.2.2.2 1.0 db @ 1550 Nm per kilometer

4.2.3 Cable Connectors: Quick-connect, simplex and duplex type ST couplers with self-centering axial alignment mechanisms. Insertion loss not more than 0.7 db.

4.2.4 Patch Panel: Pullout modular panel housing multiple-numbered connectors

4.2.5 Permanent Connection: One end of each connector module is permanently connected to an installed cable fiber.

4.2.6 Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to satisfy specified expansion criteria.

4.2.7 Mounting: Cabinet.

4.2.8 Terminations: Terminate all fiber optic cables with ST type connectors.

4.3 IDENTIFICATION PRODUCTS

4.3.1 Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

PART 5 - INSTALLATION

5.1 Each communication outlet shall consist of 4" x 4" x 2-1/2" deep box with single gang plaster ring and one individual 1" conduit connected to the cable tray.

5.2 GROUNDING

5.2.1 Comply with Electrical Section "Grounding."

5.2.2 Signal Ground Terminal: Locate in each equipment room and wiring closet. Isolate from power system and equipment grounding.

5.2.3 Signal Ground Bus: Mount on wall of main equipment room with standoff insulators.

5.2.4 Signal Ground Backbone Cable: Extend from signal ground bus to signal ground terminal in each wiring closet and equipment room.

5.3 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

5.3.1 Line walls with plywood backboards, floor to 8'-0" high.

5.3.2 Mount patch panels, terminal strips, and other connecting hardware on backboards, unless otherwise indicated.

5.3.3 Group connecting hardware for cables into separate logical fields.

5.3.4 Use patch panels to terminate cables entering the space, unless otherwise indicated.

5.4 EXAMINATION

5.4.1 Examine pathway elements to receive cable. Check raceways, cable trays, innerducts and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

5.5 APPLICATION OF MEDIA

5.5.1 Backbone Cable for Data Service: Use fiber optic cable for runs from the main Communication Room (MDF) to each intermediate Communications Room (IDF). Each fiber backbone shall consist of 1 fiber optic riser cable consisting of 12 strands each multi-mode fiber and 12 strands each single mode fiber sheathed a single jacket to each room.

5.5.2 Backbone for Voice Service: Use unshielded twisted pair cable conforming to Category 3 of the EIA/TIA-568, TSB36, for runs between the main Communication Room (MDF) to each intermediate Communications Room (IDF).

5.5.3 Horizontal Cables for Data Service: Use unshielded twisted pair cable conforming to TIA/EIA 568-B.2-1 Enhanced Category 6, for runs between wiring closets and workstation outlets. Blue plenum rated jacket.

5.5.4 Horizontal Cables for Voice (VoIP) Service: Use unshielded twisted pair cable conforming to TIA/EIA 568-B.2-1 Enhanced Category 6, for runs between wiring closets and workstation outlets. Blue plenum rated jacket.

5.5.5 Work Station Outlets-Provide one UTP cable to each outlet to be used for data only or VoIP.

5.5.6 Wiring Method: Install wiring in raceway, cable tray, and conduits except within consoles, desks, and counters unless provided. Always leave a pull string in all raceways, conduits and cable trays.

5.5.7 All risers 2 inches or larger, used as cable paths between communication closets must have textile innerducts installed prior to any type cabling pulled through the conduit.

5.5.8 Install components as indicated, according to manufacturers' written instructions. Use techniques, practices, and methods that are consistent with the Category 6 rating of the components and that assure Category 6 performance of completed and linked signal paths, end-to-end.

5.5.9 Install cable without damaging conductors, shield, or jacket.

5.5.10 Do not bend cable in handling or installation to smaller radii than minimums recommended by manufacturers.

5.5.11 Pull cables without exceeding cable manufacturer's recommended pulling tensions.

5.5.11.1 Pull cables simultaneously where more than one is being installed in the same raceway.

5.5.11.2 Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation.

5.5.11.3 Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

5.5.12 Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

5.5.13 Secure and support cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, cabinets, frames, and terminals.

5.5.14 Wiring within Wiring Closets and Enclosures: Provide adequate length of conductors. Train the conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to radii smaller than allowed. Use Velcro to secure cables. Do not use tie wraps.

5.5.15 Install communication cable from termination point in closet to outlets in lengths which do not exceed 295 ft.

5.5.16 Separation of Wires: Comply with EIA/TIA-569 rules for separation of unshielded copper voice and data system cables from potential EMI sources, including electrical feeder and branch circuits and equipment.

5.5.17 Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

5.5.18 Bundle and route the unshielded voice pair groups to the 110 type IDC connecting blocks located on the relay rack. Organize and label the cables in sequentially numbered order lowest to highest by room number.

5.5.19 Position the racks to maintain a minimum of three (3) feet clearance from the front of the rack to the front facing room wall and three (3) feet clearance from the rear of the rack to the rear facing room wall. If a row of racks is to be installed in a telecommunications room, maintain a minimum of two (2) foot clearance from the rightmost or leftmost cabinet to the opposing wall. Ground the rack to the telecommunications room grounding busbar with #6 AWG copper wire.

5.5.20 Mount the voice network riser blocks in the left most rack at the top starting under the fiber interface unit if one is installed. If no fiber interface unit is installed or to be installed in the future, start at the top. Lay out the voice network blocks in ascending serially numbered order from top left to bottom right.

5.5.21 VOICE (4-Pair) -- Use rack mounted QuickPort patch panels noted above. Punch down the four (4) unshielded pairs on the RJ45 jack. All cables terminate as 568B.

5.5.22 Minimum bend radius must meet the cable manufacturer's specifications for category 6 wiring. DATA 4-Pair -- Use rack mounted QuickPort patch panels noted above. Punch down the four (4) unshielded pairs on the RJ45 jack. All cables terminate as 568B.

5.5.23 Voice, data CATV conduit shall be clearly identified, at every junction box, via a painted section or by use of conduit stickers indicating each conduit run; Green = voice and data, Yellow = CATV, Orange = fiber optic.

5.5.24 All Telecommunication Closet Frames, Main Cross-connect Frames and connecting blocks must be properly identified by destination.

5.5.25 All riser cables shall be properly marked with "from and to" indicators. Marker is to be a flat piece of aluminum or wire tied plastic labels. This marking shall be permanent and indicate:

5.5.25.1 The Origination (Cable it is feeding from Main Cross-connect Room #) to the Destination (Telecommunications room# it is feeding).

5.5.25.2 All pairs of the riser cable must be terminated on a connecting block and identified.

5.5.26 All Telecommunication Closet Frames, Main Cross-connect Frames and connecting blocks must be properly identified by destination.

5.5.27 Contact Information Technology Network Facility Management

5.5.28 All voice jacks shall terminate in RJ45 eight (8) conductor CAT 6 modular jack assemblies. The faceplate shall be White and will support 4 modular jack assemblies. The voice jack color shall be Dark Red and will be placed in the lower left port of the wall plate. Wire color-coding and termination shall be per EIA/TIA-568B.

5.5.29 All data jacks shall terminate in RJ-45 eight (8) conductor CAT 6 modular jack assemblies. The faceplate color shall be White and will support 4 modular jack assemblies. The data jack color shall be Dark Red and will be placed in the lower left port of the wall plate. Wire color-coding and termination shall be per EIA/TIA-568B.

5.5.30 All pairs shall be terminated on either voice or data jacks.

5.5.31 UPS units

5.5.32 Install one UPS unit with an SNMP module in each communication room 123 and 212A connected to a 20amp dedicated circuit. The UPS unit is to consist of the following part numbers **(No Substitute)**:

5.5.32.1 **Base Unit: Minuteman part number E2000RM2U w/5-20P**

5.5.32.2 **SNMP Module: Minuteman part number SNMP-32L**

5.5.32.3 **Straight Blade Plug: Minuteman part number 2700005**

5.5.32.4 **12ft open end power cord: Minuteman part number 95041820**

PART 6 - IDENTIFICATION

6.1 Each end of all cables will be labeled at their termination locations.

6.2 Label all fiber cable and all fiber strands at termination locations. Information Technology Communication Services will provide fiber cable nomenclature.

6.3 All jacks shall be marked with identification numbers as described below. Information Technology Communication Services will provide the identification number range to be used for the building(s). Upon project completion, the installing contractor or designee of ITCS shall provide to ITCS a list of jack identification numbers used, their corresponding room numbers, location within the room, and punch block or data panel termination points. Jack identification numbers, at the jack locations, shall also be placed on the as built drawings provided by the contractor.

6.4 System: Use a unique alphanumeric designation to be **specified by the owner** for each cable, and label the cable and the jacks, connectors, and terminals to which it connects with the same designation. Co-ordinate with University Information Technology Communication Services staff for all communications labeling applications.

6.5 Workstation: Label cables within outlet boxes.

6.6 Outlets: Label faceplates of outlets. The font of the label must be a minimum of $1/8^{th}$ inch in height.

6.7 Distribution Cabinets and Frames: Label each unit and field within that unit.

6.8 Within Connector Fields, in Wiring Closets and Equipment Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware.

6.9 Cables, Generally: Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

6.10 Cable Schedule: Post at a prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations. Protect with a rigid frame and clear plastic cover. Provide a hard copy of final comprehensive schedules for the project.

6.11 Cable records during installation and complete sets of cable records are required at project completion. Labeling of all termination hardware and cabinets with information provided by university. A complete set of as-built drawings upon completion of the project, both on marked up blueprints. OTDR test results to manufacturer's specifications and university standards for all fiber optic cable installed. Results shall be furnished in hard copy. The documentation must include OTDR readings, fiber route diagrams including fiber cable lengths and end-to-end attenuation results for multimode and single mode fiber cable. All fiber OTDR readings shall be made bi-directional on all fiber cable. Power meter testing is suitable where distances are too short for OTDR.

PART 7 - FIELD QUALITY CONTROL

7.1 Testing: Upon installation of cable and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance. Remove temporary connections when tests have been satisfactorily completed. Terminated cable length is to be included in the test results.

7.2 Station cable tests shall be performed to manufacturer's specifications and university standards. Test results shall be provided in hard copy. Riser cable tests shall be performed to manufacturer's specifications and University standards. Test results shall be provided in hard copy. Trunk cable tests shall be performed to manufacturer's specifications and University standards. Test results shall be provided in hard copy. Terminated cable length is to be included in the test results.

7.3 Test all strands using an optical time domain reflectometer (OTDR) and optical loss test sets (OLTS). Fiber cable runs less than 150 meters in length shall be tested with an approved light meter. Provide computer readable test results of each fiber strand to Information Technology Communication Services. Terminated cable length is to be included in the test results.

7.4 The contractor shall submit, a detailed test procedure to be used for every project. All cables shall be tested for length, attenuation, impedance, grounds, shorts, reversals, and continuity of communications conductors and shields.

7.5 Upon completion, test results shall be submitted for final approval and acceptance and made part of the document. The contractor shall guarantee 100 percent continuity on all conductors and or strands on all cables. All aspects tested for each cable shall be included in the test results provided to the customer.

7.6 The testing contractor will perform verification testing it deems necessary before accepting a job. Failure during testing will result in re-pulling cables at the contractor expense.

7.7 All category 6E station cable shall be tested to category 6E standards. Station cables that do no pass the test will be repaired or replaced by the contractor at no additional cost and re-tested to meet the required specifications. Information Technology Communication Services recommends using a Fluke DSP-2000 Cable Analyzer for testing the cable or equivalent. The contractor will provide to University documented readable test results for all stations. The format will comply with Information Technology Communication Services Documentation Standards.

7.7.1 Fiber-Optic Cable Procedures: Perform each visual and mechanical inspection including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's recommendations. This test requires both visual and power loss testing. Terminated cable length is to be included in the test results.

7.8 Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

PART 8 – GROUNDING

8.1 All shields shall be bonded to a common ground.

8.1.1 The owner will verify testing if deemed necessary before accepting the job. Failure during testing will result in repulling and terminating cable at the contractor's expense.

PART 9 – CLEANING

9.1 On completion of system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

PART 10 – DEMONSTRATION

10.1 Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance. Train designated personnel in cable plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and extending wiring and establishing new workstation outlets.

10.2 Conduct a minimum of one day's training as specified in Division 1 Section "Contract Closeout." Include both classroom training and hands-on experience.

10.3 Training Aid: Use operation and maintenance manual material as an instructional aid. Provide copies of this material for use in the instruction.

10.4 Schedule training with Owner with at least 14 days' advanced notice.

PART 11 - REQUIRED SUBMITTALS

11.1 Refer to Specifications Section - General Provisions for the general requirements of submittals.

END OF SECTION

DIVISION 27 - COMMUNICATIONS

SECTION 270510 - CATV/VIDEO SYSTEM

PART 1 – GENERAL

1.1 General and special requirements apply to all work specified in this section.

1.2 Warranty on entire system shall be one year, unconditional from date of final acceptance by Owner.

1.3 See Special Note, Section 260010.

1.4 Scope of Work

1.4.1 The work to be provided under this section consists of furnishing and installing all equipment, cabling and labor required for complete, operable, new systems for the school.

1.4.2 Provide boxes and raceways as specified.

1.4.3 Provide plates as specified.

1.5 Scope

1.5.1 The work to be provided under this section includes the furnishing and installation of a Master Antenna System.

1.5.2 In general, the Master Antenna system must be capable of performing the following functions:

1.5.2.1 Distribute a professional television picture and sound program to each selected television receivers in the system.

1.5.2.2 Provide additional programming on channels 2, 4, 5 and 6 to all T.V. outlets in the system.

1.5.2.3 Provide local channels and cable programs to all T.V. outlets in the system.

1.5.2.4 The system shall be designed and equipped for all channel distribution, subsequent expansion to additional VHF or UHF channels shall require modification of head end equipment only.

PART 3 - INSTALLATION

3.1 Coordinate all locations, sizes and installation details of the TV Master Antenna System with the anticipated building construction to insure that the equipment fits the space provided for it.

3.2 The electrical subcontractor shall, after the system is installed and adjusted, notify the Owner to arrange for an acceptance test at a mutually convenient time.

3.3 The electrical subcontractor shall prove that reception quality at any outlet selected by the Owner (or his authorized representative) is equal to or better than reception normally available in the area and that signal strength is as specified.

3.4 Refer to the drawing schematics and plans for additional information.

3.5 All coaxial cable shall be run in conduit from outlet box to bridle ring system, them to head-end locations.

3.6 Contractor shall measure signal levels at each outlet upon completion and provide a written report documenting the results. Signal level shall not be less than 10db or additional work shall be done at the Contractor's expense to make system comply.

END OF SECTION.

DIVISION 27 – COMMUNICATIONS

SECTION 270720 - TELEPHONE SYSTEM

PART 1 – GENERAL

1.1 Each Electrical Contractor's attention is directed to Section 260000, General Provisions, Electrical, and all other contract documents as they may apply to his work.

PART 2 - SCOPE OF THE WORK

2.1 The Electrical Contractor shall provide the necessary labor, materials, services and coordination with the local telephone company to provide the complete telephone system indicated on the plans and specified herein. This work shall include, but is not necessarily limited to:

2.1.1 All necessary conduit, panels, voice cable, jacks, boxes, pedestals, etc., as required by the telephone company and the contract documents.

2.1.2 Making arrangements with the local telephone company for all work to be performed by them and payment of all charges made by them. The Electrical Contractor shall insure that work to be performed by the phone company is scheduled and accomplished on a timely basis so as not to delay any other parts of the construction.

PART 3 - INSTALLATION

3.1 The owner shall provide all instruments and equipment for the telephone system.

3.2 The Contractor shall install conduit system, terminations, devices, cabling, etc. as shown on the plans. Refer to section 260140 for further requirements.

END OF SECTION.

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 280750 – DIGITAL VIDEO SURVEILLANCE SYSTEM

PART 1 – DESCRIPTION OF SYSTEM COMPONENTS:

1.1 GENERAL

1.1.1 General and special requirements apply to all work specified in this section.

1.1.2 Warranty on entire system shall be one year, unconditional from date of final acceptance by Owner.

1.1.3 See Special Note, Section 260010

1.1.4 All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system.

1.1.5 All systems and components shall have been thoroughly tested and proven in actual use.

1.1.6 All systems and components shall be provided with the availability of a toll-free (U.S. and Canada), 24-hour technical assistance program (TAP) from the manufacturer. The TAP shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge for as long as the product is installed.

1.1.7 All systems and components shall be provided with a one-day turnaround repair express and 24-hour parts replacement. The manufacturer on warranty and non-warranty items shall guarantee the repair and parts express.

1.1.8 Refer to floor plans for exact number of devices and locations. Devices shall be rated for the locations shown.

PART 2 – GENERAL SPECIFICATIONS

2.1 The integrated camera and lens shall consist of a high resolution camera and varifocal lens module that is prepackaged for shipment and which shall allow the installation of the enclosure to precede installation of the camera and lens.

2.2 The integrated camera system shall provide multiple methods of installation, including the following: surface mounting onto ceiling or wall, recessed mounting in ceiling or wall, and pendant mounting with an optional parapet mount.

2.3 The DSP color CCTV camera shall meet or exceed the following design and performance specifications:

END OF SECTION

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 281300 – ACCESS CONTROL / INTRUSION SYSTEM

PART 1 – GENERAL:

1.1 Scope of Work

1.1.1 The following scope of work is to be included in this contract and does not necessarily include every item of work. The Contractor shall supply and install items that meet the specified requirements of the final order. The contractor shall provide a complete, new Security Management System (SMS) which is fully operational. The SMS is designed to secure the designated CUSTOMER facilities. The work to be provided, in addition to designing, furnishing and installing the SMS, shall include the following:

1.1.1.1 Provide Software that meets existing version being used at University.

1.1.1.2 Verification that proposed equipment and devices furnished is adequate for the intended purpose.

1.1.1.3 Perform a layout check to ensure that adequate access is available for construction, installation and maintenance of equipment and devices furnished. The Contractor shall consult the customer in the design of the workplace.

1.1.1.4 Perform acceptance tests at the site and at DPS to show system is properly installed and that it meets the specifications and applicable codes.

1.1.1.5 U of L System Administrator shall be responsible for configuring and maintaining the system. System utilities shall be provided for the System Administrator to use remote access WebClient PRO software. Software for backups and log file maintenance shall also be provided.

1.2 Scope of System

1.2.1 Basic System Characteristics: This specification is based on the capabilities of Andover Controls Continuum Security Management System. Any alternate system shall comply with all of the capabilities of the specified system and be pre-approved by the specifying engineer.

1.3 Referenced And System Certifications

1.3.1 Design and operation of the SMS shall conform to the following referenced codes, regulations, and standards as applicable:

1.3.1.1 National Electrical Code (NEC)
1.3.1.2 UL 294 Access Control Systems
1.3.1.3 UL 1076 Line Supervision
1.3.1.4 FCC Rules and Regulations
1.3.1.5 Part 15, Radio Frequency Devices
1.3.1.6 National Electrical Manufacturers Association (NEMA)
1.3.1.7 Applicable Federal, State and Local laws, regulations, codes
1.3.1.8 Americans with Disabilities Act (ADA)

1.4 System Description & Capabilities

1.4.1 Primary Function: The SMS's primary function shall be to regulate access through specific doors and gates to secured areas of the CUSTOMER facility and the option to provide photo IDs for that use. The SMS shall utilize a single database for both its access control and photo imaging functionality. This integration shall be provided under one operating environment. The SMS's workstation environment shall be Microsoft NT Workstation v4.0 operating system. No alternates will be accepted.

1.4.2 The SMS shall utilize a commercially available, Open DataBase Connectivity-compliant (ODBC), SQL open architecture relational database with flexible design allowing the integration into other data structures. This database shall handle the storage and retrieval of all cardholder records information, images, system maps, reports, and screen designs. The database shall operate in a truly muti-tasking environment without degradation of system operation and be of a design that will handle the transaction loading placed on the system. The relational database shall support on-line backup, stored procedures with control logic, and server-based referential integrity. This ODBC database engine allows for an owner to utilize "their" choice of database and due to its "open" architecture, allows an owner to write custom applications and/or reports which communicate directly with the database avoiding data transfer routines to update other applications. The system database shall contain all point configurations and programs in each of the controllers that have been assigned to the network.

1.4.3 System Design: The SMS shall be designed to perform a wide variety of features and functions. These system functions should be categorized into four (4) primary existing "system departments" which include:

1.4.3.1 Access Control: The SMS's primary purpose shall be to provide access control. The system shall be able to make access granted or denied decisions, define access privileges, and to set schedules and holiday groups. All inputs and outputs shall be capable of being transmitted globally across all system networks. And through the use of application programming these inputs and outputs shall be capable of being linked at all field controllers for purposes of implementing system-wide control strategies. The system shall support features such as area control, anti-passback, dial-up field hardware communications, extended shunt time, and multiple-man rule.

1.4.3.2 Alarm Management: The SMS shall be used for alarm monitoring. A color graphic application shall allow a user to create or import customized color graphic maps of their facility and to attach alarm icons to those maps. Alarms are to be prioritized. A status window shall provide information about the specific alarm including date and time and location of the alarm. The SMS shall allow unique emergency instructions to be specified for each type of alarm. Output control operations shall be available to lock, unlock or pulse control points, or groups of points as a standard feature. A cardholder call-up feature allows the quick search and display of images in the database. A user journal shall be available to log important daily events. A trace function shall be available for users to locate and track activity on specific cardholders or card readers. An image comparison feature shall be provided for use in conjunction with a CCTV technology interface.

1.4.3.3 Cardholder Management and Enrollment: The SMS shall include an employee management system integrated with the access control system. This employee management functionality shall allow the enrollment of cardholders into the database, capturing of images and import/export of employee data. This functionality shall also allow the user to assign or modify access privileges of a cardholder. The SMS shall include a state-of-the-art credential creation and production system integrated with the cardholder management system. This shall allow the creation of different badge types based on database fields and the use of security colors to allow security officers to quickly identify personnel access authority by the badge design.

1.4.3.4 System Administration: System Administrative tasks such as defining workstation and user permissions setup, area access, schedules, generation of reports, displaying maps, etc. shall be available at any workstation on the network. System tape back-up and remote diagnostics shall occur at the designated file server that provides the required hardware.

PART 2 – OPERATIONAL REQUIREMENTS

2.1 General

2.1.1 The design of the SMS shall include devices and equipment used to monitor and control access to restricted areas, detect and deny unauthorized entries within specific buildings or areas, annunciate alarms and generate reports. Once incorporated with the day-to-day operations of the designated facility, this system shall detect and deter unauthorized entry into restricted areas. The SMS is to be designed and configured to provide operational flexibility and reliable performance.

2.2 Functional Responsibilities

2.2.1 CUSTOMER shall have the responsibility for managing and operating the system, as well as maintaining the graphical representations of the designated facility input into the system's color graphics application. It shall be the responsibility of the CUSTOMER to enroll all personnel and capture the associated images.

2.3 Operational Concept

2.3.1 The SMS shall consist of equipment and devices placed at predetermined locations to ensure that only cardholders who are authorized to enter secured areas through certain doors or gates can do so. This shall be accomplished by means of a computer and electronic devices used in conjunction with door locks, gate systems, card readers, and/or closed circuit television.

2.3.1.1 When a new card holder needs to be added or an existing one needs to be changed, a personnel form shall be available within the SMS application. This employee data screen shall contain at a minimum 114 data entry fields of information. The card holder data screen shall allow for multiple pages of user information that can be input upon enrollment. Above and beyond the 50 fixed fields there shall also be 64 user-definable fields. These fields shall vary in character length as dictated by the system. Data fields shall be assigned as alphanumeric or numeric.

2.3.1.2 As a fundamental operation, the SMS shall provide an integrated link between the Photo Imaging and Access Control system functionality. This will allow specific information concerning personnel data to be automatically shared by utilizing a single database. Personnel data and images shall be enrolled and captured via the photo imaging application and access privileges shall be assigned via the access control application.

2.4 Distributed Intelligence

2.4.1 In the event system communications is lost or the file server fails, all Primary Network Controllers (PNC) shall provide complete control, operation and supervision of all monitoring and control points. The PNC shall be configured with a UPS battery which shall support the field controller for a minimum of 1 hour. The PNC shall be installed with enough memory to support 78,000 cardholders.

2.4.2 The SMS shall incorporate performance tests and precautions so as to avoid system failure. In the event of a failure, transactions are to be stored in a PNC FIFO buffer until the field controller comes back on-line, at which time all data is uploaded to a Workstation for reporting and delivery to the file server. The PNC shall register as on-line with the Workstations when communications are re-established. A complete download of database and access information shall not be required because of off-line operation.

END OF SECTION

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

SECTION 283100 - FIRE ALARM SYSTEM

PART 1 - SCOPE AND RELATED DOCUMENTS

1.1 The work covered by and the intent of this section of the specifications includes the furnishing of all labor, equipment, materials, testing, programming and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings, as herein specified and as required by the applicable codes.

1.2 The requirements of all other applicable conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

1.3 The complete installation shall conform to the applicable sections of NFPA-71, NFPA-72A, B, C, D, Local Code Requirements and National Electrical Code (Article 760). The requirements of any local fire department and the Authority Having Jurisdiction shall also be observed in the system installation and device layout.

1.4 The work specified under this section shall be coordinated with related work specified elsewhere in these specifications.

PART 2 - QUALITY ASSURANCE

2.1 Each and all items of the intelligent Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer. Exception as needed of: Door holders, sprinkler water flow and tamper switches. All fire alarm devices used within the system shall be listed for fire alarm service under the appropriate category by the Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label.

2.2 The system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits shall be marked in accordance with NEC Article 760.

PART 3 - GENERAL

3.1 Furnish and install an intelligent addressable multiplex fire alarm, with integral voice as a complete system as described herein and as shown on the plans; to be wired, connected, completely tested, and left in first class operating condition. The system shall use individually-addressable digital multiplex devices, communicating upon a Style “4” Signal Line Circuit(s) (SLC) with individual device supervision, appliance circuit supervision, SLC loop isolation when called for, and incoming normal and stand-by power supervision. In general, systems shall include a control panel, manual pull stations, automatic fire detectors, speakers, flashing strobe lights, annunciator(s) (if indicated), raceways, all wiring, connections to devices, connections to valve tamper switches, water flow switches and mechanical controls, outlet boxes, junction boxes, protective covers, and all other necessary materials for a complete, operating fire alarm system.

3.2 FACP Spare capacity: The FACP system shall not exceed 80% of it’s rated capacity on it’s address SLC loop, indicating and supervisory lines, allowing for 20% spare capacity for future growth.

3.3 The fire alarm control panel shall allow for loading or editing of any special instructions or operating sequences as required. No special tools, chips, modems, or an off-board programmer shall be required to program the system to facilitate future system expansion, building parameter changes, or changes as required by local codes. All instructions shall be stored in a resident non-volatile programmable memory. Provide three disk copies of final panel program at close of project, to be included in with the operation and maintenance manuals.

3.4 All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name of each component. Any catalog numbers specified under this section are intended only to

identify the type, quality of design, materials, and operating features desired. Fire alarm systems as manufactured by Simplex, Siemens or Notifier will be acceptable.

3.5 The listing of specific catalog numbers and equipment parameters is not intended to limit competition among other manufacturers that propose to supply equivalent equipment and services.

3.6 Equipment submissions for shop drawing review must include a minimum of the following:

3.6.1 Complete descriptive data indicating UL listing for all system components.

3.6.2 Complete sequence of operations of the system.

3.6.3 Complete system wiring diagrams for components capable of being connected to the system and interfaces to equipment supplied by others.

3.6.4 A copy of any state or local Fire Alarm System equipment approvals.

END OF SECTION.