DIVISION 15 - MECHANICAL SPECIFICATIONS

PART 1 GENERAL

1.1 THIS CONTRACTOR SHALL FURNISH ALL MATERIALS AND LABOR FOR A COMPLETE INSTALLATION OF THE MECHANICAL SYSTEM TO THE FULL EXTENT SHOWN ON THE DRAWINGS AND AS SPECIFIED HEREIN.

1.2 ALL FEES, PERMITS, TAXES, ETC. SHALL BE PAID BY THIS CONTRACTOR.

1.3 THIS CONTRACTOR SHALL FURNISH AND INSTALL THE EQUIPMENT AS SPECIFIED, OR SUBMIT HIS PROPOSED SUBSTITUTIONS FOR APPROVAL BEFORE INSTALLATION. SUBMIT SIX (6) COPIES OF A BOUND BROCHURE CONTAINING CATALOG SHEETS OF ALL PROPOSED PRODUCTS.

1.4 THIS CONTRACTOR SHALL VISIT THE JOB SITE AND THOROUGHLY FAMILIARIZE HIMSELF WITH THE EXISTING CONDITIONS BEFORE SUBMITTING HIS BID ON THE PROJECT. ANY DISCREPANCIES WITH THE PLANS AND SPECIFICATIONS SHALL BE IMMEDIATELY BROUGHT TO THE OWNER'S REPRESENTATIVE'S ATTENTION FOR CLARIFICATION OR RESOLUTION PRIOR TO BIDDING.

1.5 THIS CONTRACTOR SHALL GUARANTEE ALL WORK AND MATERIALS FOR A PERIOD OF ONE YEAR FROM FINAL ACCEPTANCE.

1.6 FOR A COMPLETE LIST OF OWNER FURNISHED EQUIPMENT, CONTACT OWNER'S REPRESENTATIVE.

PART 2 PRODUCTS

2.1 PIPING: ALL PIPING SHALL BE RUN SUBSTANTIALLY AS SHOWN ON THE DRAWINGS.

A. DOMESTIC HOT AND COLD WATER PIPING: SHALL BE TYPE "L" HARD DRAWN COPPER TUBING INSIDE THE BUILDING AND TYPE "K" SOFT COPPER BELOW SLAB. JOINTS PERMITTED BELOW SLAB IF SILVER SOLDER IS USED IN THE JOINTS. PROTECT FITTINGS ON COPPER PIPING FROM CONTACT WITH CONCRETE.

B. SANITARY SOIL AND WASTE PIPING: ALL SANITARY SOIL AND WASTE PIPING AND FITTINGS SHALL BE SCHEDULE 40 PVC WHERE ALLOWED BY CODE. WHERE PVC IS NOT ALLOWED BY CODE, PROVIDE STANDARD WEIGHT CAST IRON SOIL PIPE AND FITTINGS.

C. VENT PIPING: ALL VENT PIPING AND FITTINGS SHALL BE SCHEDULE 40 PVC WHERE ALLOWED BY CODE. WHERE PVC IS NOT ALLOWED BY CODE, PROVIDE STANDARD WEIGHT CAST IRON SOIL PIPE AND FITTINGS.

D. GAS PIPING: GAS PIPING ABOVE GRADE SHALL BE BLACK STEEL PIPE SCHEDULE 40. PIPE INSIDE BUILDING SHALL BE WELDED OR MALLEABLE IRON SCREWED AT THE CONTRACTOR'S OPTION. PROVIDE A FLANGED LUBRICATED PLUG GAS COCK WITH INSULATING FLANGE AND BOLTS, ABOVE GRADE WHERE GAS LINE ENTERS THE BUILDING. INSTALL A GAS COCK FOR EACH INDIVIDUAL APPLIANCE OR PIECE OF EQUIPMENT INSTALLED. A UNION SHALL BE INSTALLED BETWEEN THE GAS COCK AND THE EQUIPMENT INSTALLED.

E. GAS PIPING BELOW GRADE: SHALL BE BLACK STEEL SCHEDULE 40 WITH ALL WELDED FITTINGS. ALL BELOW GRADE GAS PIPING SHALL BE SHOP COATED AND WRAPPED. JOINTS SHALL BE COATED AND WRAPPED IN THE FIELD. PROVIDE INSULATING UNIONS AT ALL LOCATIONS WHERE THE PIPING COMES OUT OF THE GROUND TO ENTER THE BUILDING. INSTALL A 17# ANODE BETWEEN THE METER AND THE BUILDING WHERE SHOWN ON THE PLANS. AT THE CONTRACTOR'S OPTION, WHERE PERMITTED BY CODE, GAS QUALITY POLYETHYLENE PIPE MAY BE USED.

F. ROOF DRAINAGE PIPING: ALL ROOF DRAIN PIPING AND FITTINGS SHALL BE SCHEDULE 40 PVC WHERE ALLOWED BY CODE. WHERE PVC IS NOT ALLOWED BY CODE, PROVIDE BLACK STEEL PIPE SCHEDULE 40. FITTINGS SHALL BE FOR EQUAL WEIGHT AND QUALITY. ALL ELLS SHALL BE OF THE LONG RADIUS TYPE.

2.2 INSULATION: FURNISH AND INSTALL PIPE AND EQUIPMENT INSULATION AS SPECIFIED BELOW.

A. DOMESTIC COLD WATER: ALL COLD WATER PIPING ABOVE GRADE SHALL BE INSULATED WITH GLASS FIBER PIPE INSULATION IN MOLDED SECTIONS ONE INCH THICK WITH VAPOR BARRIER JACKET.

B. DOMESTIC HOT WATER: SHALL BE INSULATED AS DESCRIBED FOR DOMESTIC COLD WATER WHEN ABOVE SLABS AND WITH 1/2" THICK ARMAFLEX WHEN BELOW SLABS.

C. ROOF DRAINAGE PIPING: ALL HORIZONTAL RUNS OF ROOF DRAINAGE PIPING, ABOVE GRADE, SHALL BE INSULATED AS DESCRIBED FOR DOMESTIC COLD WATER.

2.3 PLUMBING FIXTURES: SHALL HAVE STOP VALVES ON ALL WATER CONNECTIONS. THEY SHALL HAVE C.P. ESCUTCHEONS WHERE PIPES PASS THROUGH WALLS. THEY SHALL BE PROVIDED WITH ALL NECESSARY TRIM, WHETHER SPECIFICALLY SPECIFIED HEREIN OR NOT. ALL WATER SUPPLIES SHALL HAVE 10" LONG CAPPED AIR CHAMBERS. FIXTURES SHALL BE WHITE UNLESS SPECIFIED OTHERWISE.

2.4 ROOFTOP UNITS: PROVIDE AND INSTALL ROOFTOP UNITS AS SPECIFIED. THE COOLING SECTION SHALL CONSIST OF COMPRESSORS HAVING CRANKCASE HEATERS, REFRIGERANT VALVES, AND MOTOR WINDING THERMOSTATS. UNITS SHALL BE SUITABLE FOR OPERATION BETWEEN TEMPERATURE OF 120 DEGREES TO 0 DEGREES. COOLING CAPACITY SHALL BE AS SCHEDULED. SEE SCHEDULE FOR ELECTRICAL REQUIREMENTS. EVAPORATOR FANS SHALL HAVE PERMANENTLY LUBRICATED BALL BEARING MOTORS. MOTORS SHALL HAVE THERMAL OVERLOAD PROTECTION. FANS SHALL HAVE CAPACITIES AS SCHEDULED. GAS-FIRED HEATING SECTION SHALL BE COMPLETELY ASSEMBLED, WIRED AND PIPED, CERTIFIED BY AGA FOR OUTDOOR APPLICATION. SECTION SHALL CONTAIN FACTORY TESTED HEAT EXCHANGER BURNERS, AND COMBUSTION BLOWER OF STANDARD CONSTRUCTION FOR THE SIZE UNIT SPECIFIED AND ELECTRONIC IGNITION SYSTEM. CONDENSER FANS SHALL BE DIRECT DRIVE WITH PERMANENTLY LUBRICATED BALL BEARING MOTORS HAVING THERMAL OVERLOAD PROTECTION. FAN MOTORS SHALL BE U.L. LISTED FOR OUTDOOR SERVICE. UNITS SHALL BE PROVIDED WITH MANUAL CONTROL OUTSIDE AIR VOLUME DAMPERS.
THE UNIT SHALL COME EQUIPPED WITH 1' THICK THROW AWAY FILTERS HAVING A MAXIMUM VELOCITY OF 350'/MIN. WITH THE CFM SPECIFIED. THEY SHALL COME WITH COMPLETE ROOF CURBS. CONTROLS SHALL INCLUDE CONDENSER FAN, EVAPORATOR FAN AND COMPRESSOR CONTACTORS AND 24-VOLT TRANSFORMER. PROVIDE AN ADJUSTABLE LOW VOLTAGE THERMOSTAT WITH "HEAT-OFF- COOL" AND "FAN-AUTO" SWITCHES. THE THERMOSTAT SHALL BE LOCATED WHERE SHOWN ON THE DRAWING. WIRING WILL BE PROVIDED BY THE ELECTRICAL CONTRACTOR ONLY TO THE EXTENT SHOWN ON THE ELECTRICAL PLANS. ALL OTHER WIRING SHALL BE BY THIS CONTRACTOR. CAPACITIES AND FURTHER SPECIFICATIONS SHALL BE AS SHOWN ON PLANS.

2.5 DUCTWORK: DUCTWORK SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH THE ASHRAE GUIDE. RECTANGULAR SUPPLY AND RETURN DUCTS SHALL HAVE 1/2" THICK DUCT LINER INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS FOR THE FIRST 5'-0" OF DUCT FROM THE UNIT SUPPLY AND RETURN AIR DUCT CONNECTION. RECTANGULAR SIZES SHOWN ARE SHEET METAL SIZES. ALL RECTANGULAR AND ROUND SUPPLY AND RETURN DUCTWORK SHALL HAVE 2" THICK VAPOR SEAL EXTERIOR INSULATION WITH A MINIMUM VALUE OF R-5 (INSTALLED). WHERE ROUND DUCTWORK IS SHOWN, RECTANGULAR MAY BE USED PROVIDED THE INSIDE FREE AREA IS NOT REDUCED.ROUND DUCTWORK MAY BE INSULATED FLEXIBLE DUCT AT CONNECTION TO AIR DEVICES IN LENGTHS NO GREATER THAN 6'-0".

2.6 AIR DISTRIBUTION DEVICES: SHALL BE FURNISHED AND INSTALLED AS SHOWN. FINISH SHALL BE WHITE ENAMEL UNLESS SPECIFIED OTHERWISE. MODEL NUMBERS ARE FOR DEVICES MANUFACTURED BY KRUEGER.

2.7 HOOD EXHAUST & MAKE-UP AIR SYSTEM: FANS, ROOF CURBS, AND EXHAUST DUCT TRANSITIONS ARE FURNISHED BY THE OWNER, AND INSTALLED BY THE CONTRACTOR. COORDINATE WITH THE OWNER'S REPRESENTATIVE FOR DELIVERY AND INSTALLATION REQUIREMENTS. EXHAUST DUCTWORK SHALL BE 16 GAUGE STEEL, WITH WELDED JOINTS. MAKE-UP AIR DUCTWORK SHALL BE AS DESCRIBED ABOVE IN PARAGRAPH 2.5 FOR RECTANGULAR SUPPLY AIR DUCTWORK. THE ENTIRE EXHAUST AND MAKE-UP SYSTEM SHALL BE BALANCED BY AN INDEPENDENT AABC OR NEBB CERTIFIED BALANCE CONTRACTOR. THE BALANCE CONTRACTOR SHALL PROVIDE WRITTEN REFERENCES TO THE OWNER AND SHALL PROVIDE A REPORT OF THE BALANCED SYSTEM ON STANDARD NEBB FORMS.

2.8 EXHAUST HOOD FIRE SUPPRESSION: EXHAUST HOOD WILL BE FURNISHED BY OWNER, PRE-PIPED WITH ANSUL FIRE EXTINGUISHING NOZZLES AND PIPING, FOR INSTALLATION BY THE G.C. CONTRACTOR SHALL PROVIDE AND INSTALL WET CHEMICAL FIRE SUPPRESSION SYSTEM EQUAL TO ANSUL R-102 WITH ALL RELATED ITEMS REQUIRED FOR A COMPLETE INSTALLATION. SYSTEM SHALL BE DESIGNED TO CONFORM WITH NFPA, & ALL APPLICABLE CODES AND REGULATIONS.

PART 3 EXECUTION

3.1 ALL WORK SHALL BE IN STRICT ACCORDANCE WITH ALL EXISTING CODES, ORDINANCES, AND REGULATIONS.

3.2 ALL WORK SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

3.3 THIS CONTRACTOR SHALL COORDINATE THE INSTALLATION OF THE MECHANICAL EQUIPMENT WITH THE OTHER TRADES.

3.4 EQUIPMENT SHALL BE TESTED FOR PROPER OPERATION TO INCLUDE THE BALANCING AND ADJUSTMENT OF THE SYSTEM TO THE COMPLETE SATISFACTION OF THE OWNER'S REPRESENTATIVE AND OWNER.

DIVISION 16 - ELECTRICAL SPECIFICATIONS

SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 ELECTRICAL CONTRACTOR QUALIFICATIONS
A. THE ELECTRICAL CONTRACTOR SHALL BE A COMPANY OR FIRM ENGAGED IN THE BUSINESS OF ELECTRICAL CONTRACTING ON A FULL-TIME BASIS AND HAVE HAD A MINIMUM OF THREE (3) YEARS EXPERIENCE IN THE BUSINESS OF ELECTRICAL CONTRACTING. THE FIRM SHALL HAVE COMPLETED A MINIMUM OF FIVE (5) PROJECTS SIMILAR IN SIZE AND SCOPE TO THIS PROJECT.

1.2 DESCRIPTION OF THE ELECTRICAL WORK
A. THE CONTRACTOR SHALL FURNISH ALL LABOR, MATERIALS, APPLIANCES, EQUIPMENT, TOOLS, TRANSPORTATION, SUPERINTENDENCE AND SERVICE REQUIRED TO CONSTRUCT AND INSTALL COMPLETE AND OPERATIVE IN ACCORDANCE WITH THE TRUE INTENT OF THE DRAWINGS AND SPECIFICATIONS, THE ELECTRICAL SYSTEM AS SPECIFIED HEREIN AND AS SHOWN ON THE DRAWINGS.
B. INSTALL ALL THE ELECTRICAL SYSTEMS FOR POWER AND LIGHTING, WITH CONDUIT AND OUTLETS ONLY FOR TELEPHONE, COMPUTERS AND MONITORS. LOCATIONS AS SHOWN ON PLANS. TELEPHONE CONDUIT TO BUILDING INCLUDED IF REQUIRED BY TELEPHONE COMPANY.
C. MAKE THE ROUGH-IN AND FINAL CONNECTIONS TO REFRIGERATION, EXHAUST AND INTAKE FANS, AND MENU LIGHTS. REF. "SPECIALTY ITEMS".
D. INSTALL THE CONDUITS FOR MUSIC SYSTEM AT LOCATIONS AS SHOWN ON THE PLANS, OR AS DIRECTED BY OWNER.
E. THE SPEAKERS AND MENU ASSEMBLIES SHALL BE FURNISHED BY THE OWNERS. THE ELECTRICAL CONTRACTOR SHALL BE REQUIRED TO PULL WIRES AND HOOK UP THE MENU LIGHTS. ONE MENU UNIT WILL BE LOCATED AT EACH STALL AND WILL BE INSTALLED COMPLETE WITH LAMP HOLDER AND LAMP, BY THE OWNER. THE CANOPY CONTRACTOR WILL PROVIDE ALL INSPECTION HOLES AND PLATES IN THE TUBING NECESSARY FOR THE ELECTRICAL HOOK UPS. CONDUIT FOR THE MENU LIGHTS SHALL BE ELECTRICAL CONDUIT FURNISHED AND INSTALLED BY E.C., AND RUN INTO STRUCTURE TUBING FURNISHED BY THE CANOPY CONTRACTOR.
F. THE ELECTRICAL CONTRACTOR WILL BE REQUIRED TO FURNISH CONDUIT, CIRCUITS, WIRING, AND HOOK UP THE FRONT SIGN, AND THE ENTRANCE - EXIT SIGNS. SIGNS FURNISHED BY THE OWNER.
G. ELECTRICAL CONTRACTOR SHALL PROVIDE THE WIRING AND HOOK UPS FOR THE WALK-IN COOL/FREEZER BOX, COILS AND FANS. SWITCHES AND FIXTURES FOR W/I UNITS ARE FURNISHED BY THE OWNERS. (SEE "AREA OF RESPONSIBILITIES FOR SPECIALTY ITEMS" FOR VERIFICATIONS).
H. FOR ELECTRIC COOKING THE ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL ALL SHUNT TRIP BREAKERS, OR CONTACTORS, FOR FOUR PIECES OF EQUIPMENT. (3 FRYERS & 1 GRIDDLE) WHICH ARE UNDER THE EXHAUST HOODS. LOCATIONS AND SIZES OF THE BREAKERS, CONTACTORS AS PER LOCAL ELECTRICAL REQUIREMENT, N.F.C. [illegible] 96-7-3.1.3; AND THE FIRE MARSHALL. MICROSWITCH TO BE FURNISHED BY THE FIRE EXTINGUISHER CONTRACTOR. THE ELECTRICAL CONTRACTOR SHALL HOOK UP THE MICROSWITCH WITH SHUNT BREAKERS, OR CONTACTORS. [illegible] TO BE SAME AMPERE SIZE AS THE REPLACED BREAKER. CONTACTORS ACCEPTABLE ONLY IF OWNERS APPROVED REF.SECTION 15, PART 3.
I. THE ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL THE "[illegible]" WIRE FOR THE REACH IN REFRIGERATOR. REF. "SPECIALTY ITEMS" AT FRONT OF THESE SPECIFICATIONS.
J. OWNER SHALL FURNISH AND INSTALL MUSIC SPEAKER AND WIRE TO [illegible] LOCATIONS AND SHALL ALSO FURNISH WIRING TO ALL MENU SPEAKERS. REF. "SPECIALTY ITEMS" IN FRONT OF SPECIFICATIONS.

1.3 DRAWINGS AND SPECIFICATIONS
A. THE FOLLOWING SPECIFICATIONS AND ATTACHED DRAWINGS HAVE BEEN MADE TO FORM THE BASIS FOR THE [illegible] OF THE CONTRACTOR'S WORK. THE DRAWINGS AND SPECIFICATIONS SHALL BE CONSIDERED AS MUTUALLY EXPLANATORY, AND ANY WORK REQUIRED BY ONE, BUT NOT BY THE OTHER, WILL BE PERFORMED AS THOUGH REQUIRED BY BOTH.
B. THESE DRAWINGS AND SPECIFICATIONS ARE PRESUMED TO BE ACCURATE, BUT EXTREME ACCURACY IS NOT GUARANTEED. ANY ERRORS OR AMBIGUITIES IN THE DRAWINGS AND SPECIFICATIONS THAT ARE DISCOVERED BY THE CONTRACTOR SHALL BE REPORTED TO THE OWNER'S REPRESENTATIVE BEFORE THE WORK IS STARTED. OMISSION OF PARTICULAR REFERENCE TO ANY ITEM NECESSARY FOR COMPLETE INSTALLATION AND PROPER OPERATION THEREOF SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY OF FURNISHING THE SAME AT NO EXTRA COST.
C. IN CASE OF A DISPUTE CONCERNING THE TRUE INTENT AND MEANING OF THESE DRAWINGS AND SPECIFICATIONS, THE OWNER'S REPRESENTATIVE SHALL INTERPRET THE SAME, AND THEIR INTERPRETATION SHALL BE ACCEPTED BY THE CONTRACTOR AS FINAL.
D. ANY CHANGES TO THE WORK UNDER THIS CONTRACT FROM THAT SHOWN ON THE DRAWINGS TO MAKE THE WORK CONFORM TO THE STRUCTURE, TO FIT THE WORK OF OTHER TRADES, OR ALTERNATE METHODS OF INSTALLATION PREFERRED BY THE CONTRACTOR SHALL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE FOR THEIR APPROVAL BEFORE ANY DEVIATIONS ARE MADE.

1.4 EXAMINATION OF THE SITE AND EXISTING FACILITIES
A. ALL CONTRACTORS SUBMITTING PROPOSALS FOR THIS WORK SHALL, BEFORE SUBMITTAL OF PROPOSALS, EXAMINE THE SITE AND THOROUGHLY FAMILIARIZE THEMSELVES WITH THE EXISTING CONDITIONS. ALL BIDS SHALL TAKE INTO CONSIDERATION ALL SUCH CONDITIONS THAT MAY AFFECT THE WORK UNDER THIS CONTRACT AND THE BIDDERS SHALL SATISFY THEMSELVES AS TO THE EXISTING CONDITIONS. NO INFORMATION GIVEN ON THE DRAWINGS SHALL RELIEVE THE CONTRACTOR OF THIS RESPONSIBILITY. FAILURE OF THE CONTRACTOR TO EXAMINE THE SITE AND/OR EXISTING FACILITIES WILL NOT BE CAUSE FOR EXTRAS BY REASON OF UNFORESEEN CONDITIONS.

1.5 ELECTRICAL STANDARDS, REGULATIONS, AND CODES
A. ALL ORDINANCES, LAWS, AND CODES OF THE CITY, COUNTY, STATE, AND NATIONAL GOVERNMENTS, AND THE LOCAL UTILITY COMPANY STANDARDS SHALL BE OBSERVED, AND NO WORK SHALL BE ACCEPTABLE THAT DOES NOT COMPLY. THE CONTRACTOR SHALL BE HELD RESPONSIBLE AND SHALL MAKE ANY OF THE WORK INSTALLED BY HIM CONFORM TO THESE REGULATIONS AND CODES WITH NO ADDITIONAL EXPENSE TO THE OWNER.

1.6 PERMITS, FEES, LICENSES, AND TAXES
A. ALL NECESSARY LICENSES OR PERMITS FOR THE CARRYING OUT OF THIS WORK SHALL BE SECURED AND PAID FOR BY THIS CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES SUSTAINED DUE TO HIS FAILURE TO SECURE SUCH LICENSES OR PERMITS. THIS CONTRACTOR SHALL PAY ALL TAXES APPLICABLE TO HIS WORK.

1.7 COOPERATION
A. THIS CONTRACTOR SHALL COOPERATE FULLY WITH ALL OTHER CONTRACTORS ON THIS PROJECT. IF ANY PART OF THIS CONTRACTOR'S WORK DEPENDS FOR PROPER EXECUTION OR RESULTS UPON THE WORK OF ANY OTHER CONTRACTOR, THIS CONTRACTOR SHALL INSPECT AND PROMPTLY REPORT TO THE OWNER'S REPRESENTATIVE ANY DEFECTS IN SUCH WORK THAT RENDER IT UNSUITABLE FOR SUCH EXECUTION AND RESULTS. HIS FAILURE TO SO INSPECT AND REPORT SHALL CONSTITUTE AN ACCEPTANCE OF THE OTHER CONTRACTOR'S WORK AS FIT AND PROPER FOR THE RECEPTION OF THIS WORK.

1.8 COORDINATION OF ELECTRICAL INSTALLATION
A. SEQUENCE, COORDINATE AND INTEGRATE THE VARIOUS ELEMENTS OF ELECTRICAL WORK SO THAT THE ELECTRICAL SYSTEM WILL PERFORM AS INDICATED AND BE IN HARMONY WITH THE OTHER WORK OF THE BUILDING. THE OWNER'S REPRESENTATIVE WILL NOT SUPERVISE THE COORDINATION, WHICH IS THE EXCLUSIVE RESPONSIBILITY OF THE CONTRACTOR.
B. LOCATIONS, HORSE POWER, AND ELECTRICAL RATINGS OF MOTORS AND OTHER ELECTRICAL EQUIPMENT INDICATED ON THE DRAWINGS ARE FOR GUIDANCE ONLY AND DO NOT LIMIT THE EQUIPMENT SIZES OR EXACT LOCATIONS. WHEN ELECTRICALLY OPERATED EQUIPMENT FURNISHED UNDER OTHER DIVISIONS OF THESE SPECIFICATIONS MATERIALLY DIFFERS FROM THE DESIGN SHOWN, THIS CONTRACTOR SHALL MAKE THE NECESSARY ADJUSTMENTS TO THE WIRING, DISCONNECT DEVICES, AND BRANCH CIRCUIT PROTECTION TO ACCOMMODATE THE EQUIPMENT ACTUALLY INSTALLED. COORDINATE EXACT LOCATIONS OF CONNECTIONS, ETC. WITH THE CONTRACTOR PROVIDING THE EQUIPMENT.

1.9 GUARANTEE
A. THE CONTRACTOR SHALL GUARANTEE THE APPARATUS AS INSTALLED BY HIM TO DEVELOP THE PERFORMANCE AS SPECIFIED, AND SHALL GUARANTEE TO KEEP THE ENTIRE SYSTEM AS INSTALLED BY HIM OR HIS SUBCONTRACTORS IN REPAIR AND PERFECT WORKING ORDER FOR ONE (1) YEAR AFTER DAY OF ACCEPTANCE OF SAME, AND SHALL FURNISH FREE OF COST TO THE OWNER ALL MATERIAL, LABOR AND OTHER EXPENSES NECESSARY TO COMPLY WITH THE ABOVE GUARANTEE. SAID GUARANTEE BEING BASED UPON DEFECTIVE MATERIAL, WORKMANSHIP, AND EQUIPMENT PERFORMANCE.

1.10 DAMAGE
A. DAMAGE TO THE OWNER'S PROPERTY OR OTHER CONTRACTOR'S WORK CAUSED BY THIS CONTRACTOR, OR DAMAGE DUE TO FAILURE OF HIS EQUIPMENT OR MATERIALS, SHALL BE REPAIRED OR REPLACED AT THIS CONTRACTOR'S EXPENSE.

1.11 SUBSTITUTIONS OF SPECIFIED MATERIALS AND EQUIPMENT
A. WHERE A MANUFACTURER AND CATALOG/MODEL NUMBER OF A PIECE OF EQUIPMENT IS NAMED ON THE PLANS OR IN THE SPECIFICATIONS, THAT MANUFACTURER'S AND CATALOG/MODEL NUMBER IS CONSIDERED TO BE THE STANDARD OF QUALITY FOR THAT PIECE OF EQUIPMENT AND EQUAL PRODUCTS OF OTHER MANUFACTURERS WILL BE GIVEN CONSIDERATION.

1.12 APPROVAL OF MATERIALS
A. THE CONTRACTOR MUST OBTAIN IN WRITING THE OWNER'S REPRESENTATIVE'S APPROVAL OF EACH ITEM SUBMITTED. THE OWNER'S REPRESENTATIVE'S APPROVAL OF SUCH SUBMITTALS SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY FOR PROPER PERFORMANCE OF ALL EQUIPMENT OR DEVIATIONS FROM THE DRAWINGS OR THE SPECIFICATIONS, UNLESS HE HAS IN WRITING DIRECTED THE ATTENTION OF THE OWNER'S REPRESENTATIVE TO SUCH DEVIATIONS AT THE TIME OF SUBMISSIONS. THE OWNER'S REPRESENTATIVE WILL NOT GIVE VERBAL APPROVAL OF ANY SUBSTITUTE EQUIPMENT.

1.13 MODIFICATION PROPOSALS (RFP)
A. AFTER BIDS ARE RECEIVED ON THE PROJECT, THE OWNER'S REPRESENTATIVE MAY ISSUE A REQUEST FOR PROPOSAL (RFP) FOR PROPOSED CHANGES TO THE WORK ON THIS PROJECT. THIS CONTRACTOR SHALL PREPARE A PRICE PROPOSAL FOR THE PROPOSED CHANGE(S) TO HIS WORK. THE PROPOSAL SHALL CONTAIN A PRICE BREAKDOWN IN SUFFICIENT DETAIL TO PERMIT AN ANALYSIS OF ALL MATERIAL, LABOR, EQUIPMENT, SUBCONTRACT, AND OVERHEAD COSTS AS WELL AS PROFIT. THE PRICE BREAKDOWN SHALL COVER ALL WORK INVOLVED TO ACCOMPLISH THE MODIFICATION, WHETHER DELETED, ADDED, OR CHANGED.
B. ANY CHANGE AMOUNTS CLAIMED FOR SUBCONTRACTORS SHALL BE SUPPORTED BY A SIMILAR BREAKDOWN. IF THE PROPOSAL INCLUDES A TIME EXTENSION, A JUSTIFICATION THEREOF SHALL ALSO BE FURNISHED. THE PROPOSAL TOGETHER WITH THE PRICE BREAKDOWN AND TIME EXTENSION JUSTIFICATION SHALL BE FURNISHED BY SUCH DATE AS MAY BE REQUIRED BY THE OWNER'S REPRESENTATIVE.

1.14 AS CONSTRUCTED DRAWINGS, EQUIPMENT CATALOG, SPARE MATERIALS
A. AT THE COMPLETION OF THE PROJECT, AND BEFORE FINAL PAYMENT IS MADE, THIS CONTRACTOR SHALL FURNISH THE FOLLOWING:
B. SUBMIT TO THE OWNER'S REPRESENTATIVE FOR TRANSMITTAL TO THE OWNER:
1. ONE (1) NEAT, CLEAN, COMPLETE SET OF ELECTRICAL WORKING DRAWINGS ON WHICH ANY AND ALL CHANGES MADE IN THE INSTALLATION OF THE ELECTRIC SYSTEM HAVE BEEN NEATLY MARKED IN COLORED PEN OR PENCIL. THESE MARKED CHANGES SHALL INCLUDE ANY CHANGES IN ROUTING OF CONDUITS, RELOCATED ELECTRICAL EQUIPMENT, ETC. MARK THE SET OF ELECTRICAL DRAWINGS TO INDICATE ALL CHANGES MADE DURING THE PROGRESS OF THE WORK. LOCATE ALL UNDERGROUND CONDUITS WITH DIMENSIONS. SHOW THE ACTUAL PANELBOARD CIRCUIT NUMBER OF EACH CIRCUIT.
2. ONE (1) LOOSE-LEAF THREE-RING BINDER WITH TABS CONTAINING A COMPILATION OF CATALOG DATA OF EACH MANUFACTURED ITEM OF EQUIPMENT USED IN THE ELECTRICAL WORK. DESCRIPTIVE DATA AND PRINTED INSTALLATION, OPERATING, INSTRUCTIONS, GUARANTEES, WARRANTIES, MAINTENANCE AGREEMENTS, MAINTENANCE PROPOSALS AND MAINTENANCE INSTRUCTIONS FOR EACH ITEM OF EQUIPMENT SHALL BE INCLUDED. A COMPLETE TYPE WRITTEN INDEX SHALL BE PROVIDED LISTING EACH PRODUCT ALPHABETICALLY BY NAME TOGETHER WITH THE MANUFACTURER, CATALOG NUMBER, AND NAME AND ADDRESS OF THE AREA SALES REPRESENTATIVE.
3. TWO KEYS OF EACH TYPE OF KEY ON THE JOB.
4. DELIVER SPARE FUSES, LAMPS, AND OTHER SPARE EQUIPMENT AND STORE AS DIRECTED.

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. THE DIVISION 1 GENERAL CONDITIONS APPLYING TO THE GENERAL CONTRACTOR ALSO APPLY TO THIS SUBCONTRACTOR AS MODIFIED BY DIVISION 16 REQUIREMENTS.

1.2 WORKMANSHIP
A. THE WORK TO BE PERFORMED AS A PART OF THIS CONTRACT SHALL BE DONE BY EXPERIENCED CRAFTSMEN IN A NEAT, CAREFUL, AND WORKMAN-LIKE MANNER, AND IN FULL COMPLIANCE WITH ALL REQUIREMENTS OF THE NEC, LATEST REVISION, AND SHALL CONFORM TO THE BEST PRACTICES OF THE ELECTRICAL INDUSTRY.

1.3 STORAGE OF MATERIALS
A. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER CARE OF ALL HIS MATERIALS, EQUIPMENT, ETC., DELIVERED AT THE SITE. BUILDING MATERIALS, CONTRACTOR'S EQUIPMENT, ETC., MAY BE STORED ON THE PREMISES, BUT THE PLACING OF SAME SHALL BE SUBJECT TO THE APPROVAL OF THE OWNER'S REPRESENTATIVE. WHEN ANY ROOM IN THE BUILDING IS USED AS A SHOP, STOREROOM, ETC., THE ONE MAKING USE OF SUCH ROOM WILL BE HELD RESPONSIBLE FOR ANY REPAIRS, PATCHING OR CLEANING ARISING FROM SUCH USE.

1.4 DAMAGE
A. THIS CONTRACTOR SHALL PROTECT AND BE RESPONSIBLE FOR ANY DAMAGE TO HIS WORK OR MATERIAL, FROM THE DATE OF AGREEMENT UNTIL THE FINAL ACCEPTANCE IS MADE, AND SHALL MAKE GOOD WITHOUT COST TO THE OWNER ANY DAMAGE OR LOSS THAT MAY OCCUR DURING THIS PERIOD. CONTRACTOR SHALL HANDLE ALL MATERIAL AS DIRECTED, SO THAT IT MAY BE INSPECTED BY THE OWNER'S REPRESENTATIVE.

1.5 ELECTRICAL SYSTEM PERFORMANCE
A. PERFORM REQUIRED TESTS AND PROCURE REQUIRED APPROVALS OF ALL AUTHORITIES, PRIOR TO THE OWNERS ACCEPTANCE AND OCCUPANCY.
B. THE SYSTEM WILL NOT BE CONSIDERED FOR ACCEPTANCE UNTIL ALL THE SWITCHES, PANELS, BREAKERS, SAFETY SWITCHES, MOTORS, LIGHT FIXTURES, RECEPTACLES, DEVISES, AND ITEMS OF EQUIPMENT ARE OPERATED UNDER LOAD CONDITIONS AND FOUND TO CONFORM TO THE CONTRACT DOCUMENTS BY THE OWNER.

1.6 EXCAVATION AND BACKFILL
A. THIS CONTRACTOR SHALL PERFORM ALL NECESSARY TRENCH EXCAVATION AND BACKFILL FOR THE VARIOUS UNDERGROUND PORTIONS OF CONDUIT NECESSARY FOR THE COMPLETION OF THE WORK. MATERIAL SUITABLE FOR BACKFILL IS TO BE PILED [illegible] TO INTERFERE WITH SAND OR OTHER SUITABLE MATERIAL CONTAINING NO WOOD OR OTHER ORGANIC MATTER SUBJECT TO DECAY. BACK FILLS SHALL BE PLACED IN LAYERS NOT OVER SIX INCHES, AND EACH LAYER THOROUGHLY TAMPED AND COMPACTED. WHERE TRENCHES ARE UNDER BUILDING, PAVED AREAS, ETC., SAND BACKFILL SHALL BE BROUGHT TO THE ELEVATION OF THE ADJACENT GRADES.

1.7 CLEANING AND TOUCH-UP
A. PRIOR TO FINAL INSPECTION THE CONTRACTOR SHALL CLEAN THE CONSTRUCTION DUST FROM ALL LIGHTING FIXTURES AND LAMPS, CLEAN ANY [illegible] OR OTHER FOREIGN MATERIAL FROM ALL PANELBOARDS AND DEVICES AND TOUCH-UP PAINT ON ALL ELECTRICAL EQUIPMENT.

1.8 ELECTRICAL SERVICE
A. PRIOR TO SUBMITTING A PROPOSAL FOR THE WORK, THE CONTRACTOR SHALL CONTACT THE LOCAL ELECTRICAL UTILITY COMPANY AND DETERMINE THE REQUIREMENTS FOR ELECTRICAL SERVICE TO THE BUILDING. THE CONTRACTOR SHALL INCLUDE ALL CHARGES BY THE UTILITY COMPANY FOR SERVICE IN THEIR BID PROPOSAL.
B. AFTER THE NOTICE TO PROCEED IS ISSUED, THE ELECTRICAL CONTRACTOR SHALL CONTACT THE LOCAL ELECTRICAL UTILITY COMPANY REPRESENTATIVE AND COORDINATE THE INSTALLATION OF THE ELECTRICAL SERVICE WITH THE UTILITY COMPANY.

1.9 TELEPHONE SERVICE
A. TELEPHONE SERVICE CABLES TO THE BUILDING WILL BE FURNISHED AND INSTALLED BY THE TELEPHONE UTILITY COMPANY. THE CONTRACTOR SHALL FURNISH AND INSTALL RACEWAYS FOR THE TELEPHONE SERVICE CABLES AS REQUIRED BY THE TELEPHONE COMPANY.
B. INTERIOR TELEPHONE WIRING WILL BE FURNISHED AND INSTALLED BY OTHERS.

SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.1 MATERIALS
A. MATERIALS SHALL BE NEW AND A STANDARD CATALOGED PRODUCT OF THE MANUFACTURER. EXPERIMENTAL OR UNPROVEN DESIGNS WILL NOT BE ACCEPTABLE.

PART 2 - PRODUCTS

2.1 GENERAL
A. ALL WIRING SHALL BE INSTALLED IN NEW, 1/2" MINIMUM, GALVANIZED OR SHERARDIZED, STEEL CONDUITS SIZED AS INDICATED ON THE DRAWINGS OR ACCORDING TO TABLE IV OF THE NEC IF NOT SPECIFICALLY SHOWN. CONDUITS INSTALLED IN OR UNDER THE FLOOR SLAB SHALL BE 3/4" MINIMUM SIZE.
B. REFER TO SECTION 16120 FOR MC CABLE OPTIONS.

2.2 RIGID GALVANIZED STEEL (RGS) CONDUITS AND FITTINGS
A. CONDUITS SHALL BE HOT-DIP GALVANIZED WITH UNDERWRITERS' APPROVAL AND LABEL. RGS CONDUITS SHALL BE PROVIDED AT THE FOLLOWING LOCATIONS:
1. ALL CONDUITS 2" AND LARGER.
2. CONDUITS EXPOSED TO THE OUTDOOR WEATHER.
3. CONDUITS EXPOSED IN MECHANICAL AND ELECTRICAL ROOMS WERE PHYSICAL DAMAGE MAY OCCUR.
4. CONDUITS INSTALLED IN CONCRETE OR MASONRY.
B. COATED RGS CONDUITS SHALL BE PROVIDED FOR ALL CONDUITS IN CONTACT WITH THE EARTH, BOTH UNDER THE BUILDING AND OUTSIDE THE BUILDING. PROVIDE CORROSION PROTECTION EQUIVALENT TO BEING WRAPPED WITH TEN MIL VINYL PLASTIC TAPE MANUFACTURED FOR THIS PURPOSE. THREADED COUPLINGS SHALL BE USED ON ALL RGS CONDUITS.

2.3 ELECTRICAL METALLIC TUBING (EMT)
A. EMT AND FITTINGS SHALL BE ELECTROGALVANIZED, HAVE LIQUID TIGHT CONNECTORS, AND SHALL HAVE UL APPROVAL AND LABEL. EMT CONDUITS SHALL BE PROVIDED FOR CONDUITS 1 1/2" OR SMALLER THAT WILL BE CONCEALED ABOVE CEILINGS AND IN WALL SPACES. EMT MAY BE RUN EXPOSED IN SMALL CLOSETS, OR HIGH IN AN EXPOSED STRUCTURE WHERE THE EMT IS WELL PROTECTED FROM PHYSICAL DAMAGE. EMT COUPLINGS SHALL BE COMPRESSION TYPE COUPLINGS.

2.4 FLEXIBLE METAL CONDUITS
A. FLEXIBLE CONDUITS FOR INDOOR AND DRY LOCATIONS SHALL BE HEAVY WALL ZINC COATED STEEL WITH UL LABEL. "REDUCED WALL" FLEXIBLE STEEL CONDUITS ARE NOT ACCEPTABLE.
B. FOR OUTDOOR OR WET LOCATIONS, PROVIDE FLEXIBLE CONDUIT WITH A PVC LIQUID-TIGHT JACKET AND LIQUID-TIGHT FITTINGS EQUAL TO "SEAL-TIGHT".

2.5 CONDUIT FITTINGS
A. CONDUIT FITTINGS SHALL CONFORM TO UL 467 AND UL 514 AS APPLICABLE FOR RIGID METAL CONDUIT, FLEXIBLE METAL CONDUIT, EMT, AND MI CABLE. FITTINGS FOR EMT SHALL BE COMPRESSION TYPE. FITTINGS FOR RIGID METAL CONDUITS SHALL BE THREADED. FITTINGS FOR ALL TYPES OF CONDUITS SHALL BE OF THE SAME MATERIAL AS THE CONDUIT AND WHEN INSTALLED UNDERGROUND OR IN WET LOCATIONS, THEY SHALL PROVIDE A WATERTIGHT JOINT.
B. EXPANSION JOINT FITTINGS SHALL BE PROVIDED WHERE CONDUITS PASS THROUGH BUILDING EXPANSION JOINTS. FITTINGS SHALL BE TELESCOPIC AND WATERPROOF AND PERMIT A MOVEMENT UP TO 4 INCHES. FITTINGS SHALL BE EQUIPPED WITH APPROVED BONDING JUMPERS AROUND OR THROUGH EACH FITTING.

2.6 WIREWAYS
A. WIREWAYS SHALL BE ZINC COATED RIGID STEEL SHEETS, FORMED INTO RECTANGULAR OR SQUARE SHAPES, TOTALLY ENCLOSED WITH HINGED COVER OR SCREW FASTENED COVER, AND SIZED AS INDICATED ON THE DRAWINGS OR AS REQUIRED BY THE NEC. WIREWAYS SHALL BE FURNISHED COMPLETE WITH ALL NECESSARY ACCESSORIES AND FITTINGS.

2.7 CONDUIT SUPPORTS
A. CONDUIT SUPPORTS, CLAMPS, AND FASTENERS SHALL BE "CADDY" OR EQUAL.

2.8 PLASTIC CONDUIT (PVC) SUBSTITUTE FOR METAL CONDUITS
A. PVC CONDUITS MAY BE SUBSTITUTED FOR RIGID STEEL GALVANIZED CONDUITS AS FOLLOWS:
1. CARLON PLUS 40, TYPE 40, 90 DEG. C, UL RATED POLYVINYL CHLORIDE MAY BE SUBSTITUTED FOR THE RIGID STEEL CONDUIT SYSTEMS LISTED ABOVE AND ONLY FOR INSTALLATION IN CONCRETE, MASONRY, DIRECT BURIED IN EARTH, OR IMBEDDED IN OR UNDER THE FLOOR SLABS. REQUIREMENTS FOR SUBSTITUTION ARE:
A. PULL A PROPERLY SIZED GREEN GROUNDING CONDUCTOR AND CONNECT TO GROUND TERMINALS IN THE BOXES.
B. SOLVENT WELD ALL FITTINGS AND MAKE WATERTIGHT.
C. FITTINGS, COUPLINGS, AND CEMENT TO BE AS MANUFACTURED BY CARLON OR EQUAL.
D. MAIN SERVICE CONDUITS SHALL BE CONCRETE ENCASED WITH A MINIMUM OF 4" CONCRETE COVER ON ALL SIDES OF CONDUITS. INSTALL SPACERS BETWEEN CONDUITS IN MULTIPLE CONDUIT RUNS.
E. ALL ELBOWS 1" AND LARGER SHALL BE RIGID STEEL GALVANIZED.
F. CONDUITS EXPOSED BETWEEN FLOORS AND PANELBOARDS SHALL BE RIGID STEEL GALVANIZED.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION AND WIRING METHODS
A. CONDUITS IN GENERAL SHALL BE CONCEALED THROUGHOUT, EXCEPT IN MECHANICAL ROOMS, ETC., OR WHERE SPECIFICALLY SHOWN TO BE EXPOSED ON THE DRAWINGS.
B. INSTALL CONDUITS STRAIGHT AND TRUE, ALIGNED WITH OTHER WORK, CLOSE TO WALLS AND OVERHEAD STRUCTURE, CONCEALED WHERE POSSIBLE IN OCCUPIED SPACES, AND OUT-OF-WAY WITH MAXIMUM PASSAGEWAY AND HEADROOM REMAINING IN EACH SPACE. EXCEPT AS OTHERWISE INDICATED, ARRANGE ELECTRICAL SERVICES AND OVERHEAD EQUIPMENT WITH A MINIMUM OF 7'-0" HEADROOM IN STORAGE SPACES, AND 8'-6" HEADROOM IN OTHER SPACES. ARRANGE WORK TO FACILITATE MAINTENANCE AND REPAIR OR REPLACEMENT OF EQUIPMENT. LOCATE SERVICES REQUIRING MAINTENANCE ON WIRING DEVICES AND SIMILAR UNITS IN FRONT OF SERVICES REQUIRING LESS MAINTENANCE. CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM OF INTERFERENCE WITH LUMINARIES, WITH CEILING FINISH, SUSPENSION, DUCTWORK, AIR DIFFUSERS AND OTHER WORK, SO THAT REQUIRED PERFORMANCES OF EACH WILL BE ACHIEVED.
C. SUPPORT CONDUITS FROM STRUCTURE WITH STRAPS ON SMALL CONDUITS, AND CONDUIT HANGERS ON LARGE CONDUITS. MAINTAIN ELECTRICAL CONTINUITY THROUGHOUT THE SYSTEM. PLUG ENDS AND KEEP CONDUIT CLEAN DURING CONSTRUCTION. INSTALL REMOVABLE COVER PULL BOXES ON LONG RUNS. INSTALL EXPANSION FITTINGS AT BUILDING EXPANSION JOINTS AND RUNS OVER 150 FEET LONG. INSTALL #16 PULL WIRE IN EMPTY CONDUITS. ALLOW FOR NATURAL DRAIN OF CONDENSATE. INSTALL CONDUIT BUSHINGS AT ALL BOXES, CABINETS, ETC. AND AT THE TERMINATION ENDS OF CONDUIT STUB-OUTS.
D. ALL CONDUITS INSTALLED BELOW GRADE OR UNDERFLOOR SHALL BE RIGID STEEL GALVANIZED WITH THREADED COUPLINGS (OR P.V.C. WITH CEMENTED COUPLINGS IF SPECIFICALLY SPECIFIED IN THIS SECTION). NO SET-SCREW COUPLINGS WILL BE ALLOWED. CONDUIT THREADS SHALL BE COATED WITH AN APPROVED SEALANT AND TIGHTENED SECURELY TO MAKE EACH JOINT WATERPROOF.
E. ALL UNDERGROUND CONDUITS INSTALLED OUTSIDE THE BUILDING OR STRUCTURE SHALL BE INSTALLED AT DEPTHS AS SPECIFIED IN TABLE 300-5 OF THE NEC. INSTALL CONTINUOUS PLASTIC TAPE MARKERS PER SECTION 16195 OVER THE CONDUIT RUNS AT 6" BELOW GRADE.
F. CONNECT ALL VIBRATING EQUIPMENT, DRY-TYPE TRANSFORMERS, MOTORS, AND RECESSED LIGHTING FIXTURES WITH A LENGTH OF FLEXIBLE CONDUIT NO SHORTER THAN 12" IN LENGTH. WHEN EXPOSED TO MOISTURE, OILS, VAPORS, ACIDS, ETC., CONNECT ALL VIBRATING EQUIPMENT WITH A 12" MINIMUM LENGTH OF "SEALTITE" FLEXIBLE CONDUIT, WITH APPROPRIATE FITTINGS.
G. FLEXIBLE CORD/CAP AND RECEPTACLE CONNECTION FOR MOTORS IS NOT ACCEPTABLE UNLESS SPECIFICALLY INDICATED ON THE DRAWINGS.

SECTION 16120 - WIRES AND CABLES

PART 1 - GENERAL

1.1 CODES AND STANDARDS
A. NEC COMPLIANCE: COMPLY WITH APPLICABLE REQUIREMENTS OF NEC FOR CONSTRUCTION AND INSTALLATION OF WIRES/CABLES AND CONNECTORS.
B. UL COMPLIANCE: COMPLY WITH UL STDS 83 AND 486A. PROVIDE WIRING/CABLING AND CONNECTOR PRODUCTS WHICH ARE UL-LISTED AND LABELED CONSISTENT WITH THEIR USES.

PART 2 - PRODUCTS

2.1 WIRES AND CABLES:
A. PROVIDE WIRES AND CABLES AS INDICTED SUITABLE FOR THE TEMPERATURE, CONDITIONS AND LOCATION WHERE INSTALLED. INSTALL ALL WIRE IN RACEWAY.
B. CONDUCTOR MATERIAL: USE COPPER CONDUCTORS FOR ALL WIRES AND CABLES.
C. INSULATION: PROVIDE THHN/THWN INSULATION FOR ALL CONDUCTORS SIZE 500MCM AND LARGER AND NO. 8 AWG AND SMALLER. FOR ALL OTHER SIZES PROVIDE THW, THHN/THWN OR XHHW INSULATION AS APPROPRIATE FOR THE LOCATIONS WHERE INSTALLED.
D. CONNECTORS FOR CONDUCTORS: PROVIDE UL-LISTED FACTORY-FABRICATED, SOLDERLESS METAL CONNECTORS OF SIZES, AMPACITY RATINGS, MATERIALS, TYPES AND CLASSES FOR APPLICATIONS AND FOR SERVICES INDICATED. USE CONNECTORS WITH TEMPERATURE RATINGS EQUAL TO OR GREATER THAN THOSE OF THE WIRES UPON WHICH USED.
E. OPTIONAL USE OF TYPE MC CABLES: THE CONTRACTOR MAY USE TYPE MC CABLE IN LIEU OF WIRE INSTALLED IN CONDUITS WHERE APPROVED BY LOCAL CODES. TYPE MC CABLE SHALL BE INSTALLED ONLY IN HOLLOW WALL SPACES AND ABOVE ACCESSIBLE CEILINGS.

PART 3 - EXECUTION

3.1 WIRING INDICATED ON DRAWINGS
A. THE NUMBER OF WIRES TO BE INSTALLED IN EACH CONDUIT RUN IS INDICATED ON THE DRAWINGS AS HASH MARKS. REFER TO THE ELECTRICAL SYMBOLS.
B. EACH CONDUIT RUN SHALL HAVE A GREEN GROUNDING CONDUCTOR INSTALLED WITH THE PHASE AND NEUTRAL CONDUCTORS. THE GROUNDING CONDUCTOR SHALL BE SIZED AS INDICATED AND/OR PER THE NEC. REFER TO SECTION 16452.
C. NEUTRALS SHALL NOT BE COMBINED ON CIRCUITS SERVING LIGHTING FIXTURES CONTAINING ELECTRONIC BALLASTS. A SEPARATE NEUTRAL SHALL BE PULLED FOR EACH CIRCUIT.

3.2 INSTALLATION METHODS
A. PULL CONDUCTORS SIMULTANEOUSLY WHERE MORE THAN ONE IS BEING INSTALLED IN SAME RACEWAY. USE UL LISTED PULLING COMPOUND OR LUBRICANT, WHERE NECESSARY.
B. USE PULLING MEANS INCLUDING, FISH TAPE, CABLE, ROPE AND BASKET WEAVE WIRE/CABLE GRIPS WHICH WILL NOT DAMAGE CABLES OR RACEWAYS. DO NOT USE ROPE HITCHES FOR PULLING ATTACHMENT TO WIRE OR CABLE.
C. TIGHTEN ELECTRICAL CONNECTORS AND TERMINALS, INCLUDING SCREWS AND BOLTS, IN ACCORDANCE WITH MANUFACTURER'S PUBLISHED TORQUE TIGHTENING VALUES. WHERE MANUFACTURER'S TORQUING REQUIREMENTS ARE NOT INDICATED, TIGHTEN CONNECTORS AND TERMINALS TO COMPLY WITH TIGHTENING TORQUES SPECIFIED IN UL STD 486A AND B.
D. THE WIRING LAYOUT INDICATED ON THE DRAWINGS IS INTENDED TO BE SCHEMATIC AND MINOR VARIANCES TO ACCOMMODATE THE BUILDING STRUCTURE ARE ACCEPTABLE. IF THE CONTRACTOR DESIRES TO MAKE MAJOR MODIFICATIONS TO THE GENERAL LAYOUT, (IE. INSTALL CONDUITS OVERHEAD WHERE INDICATED TO BE UNDERFLOOR, ETC.), HE SHALL OBTAIN THE APPROVAL OF THE OWNER'S REPRESENTATIVE BEFORE BEGINNING THE CHANGES.

SECTION 16135 - CABINETS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.1 MATERIALS
A. MATERIALS SHALL BE NEW AND A STANDARD CATALOGED PRODUCT OF THE MANUFACTURER. EXPERIMENTAL OR UNPROVEN DESIGNS WILL NOT BE ACCEPTABLE.

PART 2 - PRODUCTS

2.1 OUTLET BOXES
A. BOXES SHALL BE PROVIDED IN THE WIRING OR RACEWAY SYSTEMS WHEREVER REQUIRED FOR PULLING OF WIRES, MAKING CONNECTIONS, AND MOUNTING DEVICES OR FIXTURES. CONSTRUCTION AND DESIGN OF BOXES TO BE THE BEST ADAPTED FOR THE LOCATION, FIXTURE AND/OR DEVICE. BOXES SHALL COMPLY WITH UL 514 EXCEPT THAT BOXES LOCATED IN HAZARDOUS LOCATIONS SHALL COMPLY WITH THE UL REQUIREMENTS FOR THE CLASS AND GROUP INDICATED AND/OR SPECIFIED. BOXES SHALL BE OF THE CAST METAL HUB TYPE WHEN LOCATED IN NORMALLY WET LOCATIONS, WHEN SURFACE MOUNTED ON OUTSIDE OF EXTERIOR SURFACES AND WHEN INSTALLED EXPOSED UP TO SEVEN (7) FEET ABOVE INTERIOR FLOORS AND WALKWAYS. BOXES IN OTHER LOCATIONS SHALL BE SHEET STEEL. THROUGH WALL BACK-TO-BACK BOXES ARE NOT ALLOWABLE.
B. BOXES FOR USE WITH RACEWAY SYSTEMS SHALL NOT BE LESS THAN 1.5 INCHES DEEP EXCEPT WHERE SHALLOWER BOXES REQUIRED BY STRUCTURAL CONDITIONS ARE APPROVED. BOXES FOR OTHER THAN LIGHTING FIXTURE OUTLETS SHALL NOT BE LESS THAN 4 INCHES SQUARE EXCEPT THAT 4 INCH BY 2 INCH BOXES MAY BE USED WHERE ONLY ONE RACEWAY ENTERS THE OUTLET. BOXES LESS THAN 4 INCHES SQUARE FOR MOUNTING LIGHTING FIXTURES MAY BE INSTALLED AS REQUIRED BY FIXTURE CONFIGURATION, AS APPROVED.
C. PULL BOXES SHALL BE CONSTRUCTED OF CODE GAGE GALVANIZED SHEET STEEL EXCEPT WHERE CAST METAL BOXES ARE REQUIRED IN LOCATION SPECIFIED HEREIN.
D. COVERS SHALL BE PROVIDED ON OUTLET BOXES, PULL BOXES AND JUNCTION BOXES IF NO DEVICE OR FIXTURE IS ATTACHED. COVERS SHALL BE BLANK, SUITABLE FOR PAINTING AND EXACTLY FIT THE BOX.

PART 3 - EXECUTION

3.1 INSTALLATION
A. WIRING DEVICE BOXES AND PLATES, ETC., SHALL BE ACCURATELY SET PLUMB AND LEVEL. EXPOSED CONDUITS OR WIREMOLD SHALL BE RUN PARALLEL TO OR AT RIGHT ANGLES TO BUILDING LINES, HORIZONTAL RUNS LEVEL, AND VERTICAL LINES PLUMB.
B. BOXES SHALL BE MOUNTED TO THE BUILDING STRUCTURE WITH APPROVED MOUNTING CLIPS EQUAL TO CADDY.
C. ALL BOXES MOUNTED IN METAL STUD WALLS SHALL BE MOUNTED WITH APPROVED MOUNTING CLIPS AND CONDUITS SECURED WITH APPROVED CLIPS. 4" BOXES MOUNTED TO METAL STUDS SHALL HAVE FAR-SIDE BOX SUPPORTS.

SECTION 16143 - WIRING DEVICES

PART 1 - GENERAL

1.1 MATERIALS
A. EQUAL DEVICES AS MANUFACTURED BY G.E., P & S, LEVITON, OR HUBBELL WILL BE ACCEPTABLE.

PART 2 - PRODUCTS

2.1 SWITCHES:
A. SINGLE POLE SWITCHES: HUBBELL #1201 GRAY.
B. PILOT LIGHT SWITCHES: HUBBELL #1201PL.

2.2 RECEPTACLES:
DUPLEX RECEPTACLES SHALL COMPLY WITH NEMA PUBLICATION WD-1, AND SHALL BE EQUAL TO THE FOLLOWING.
A. DUPLEX RECEPTACLES: HUBBELL #5252 GRAY.
B. OUTDOOR WP RECEPTACLES: HUBBELL #GF5362GY. FURNISH #WP-26 PLATE FOR VERTICALLY MOUNTED RECEPTACLES, #CWP26H FOR HORIZONTAL MOUNTED RECEPTACLES.
C. INDOOR GFI RECEPTACLES: HUBBELL #GF5362 WITH SS PLATE.
D. THREE AND FOUR WIRE RECEPTACLES: HUBBELL; TYPE, VOLTAGE, CONFIGURATION, AND CAPACITY AS NOTED ON THE DRAWINGS.
E. ISOLATED GROUND DUPLEX RECEPTACLES: HUBBELL #IG5262

2.3 MISCELLANEOUS DEVICES:
A. DEVICE PLATES: UNLESS NOTED OTHERWISE, ALL DEVICE PLATES SHALL BE TYPE 302 STAINLESS STEEL AS MANUFACTURED BY SIERRA.
B. ALL SWITCHES AND OUTLETS SHALL BE FURNISHED WITH OVERSIZED STAINLESS STEEL COVER PLATES.
C. COVERPLATES FOR DATA OUTLETS SHALL BE TYPE 302 STAINLESS STEEL CATALOG NUMBER S-753N AS MANUFACTURED BY SIERRA. REMOVE GROMMET.

2.4 TELEPHONE AND DATA OUTLETS
A. TELEPHONE AND DATA OUTLETS SHALL BE A SINGLE GANG OUTLET BOX WITH A 3/4" EMPTY CONDUIT STUBBED INTO ACCESSIBLE CEILING SPACE. INSTALL A 90 DEGREE BEND ON THE CONDUIT ABOVE THE CEILING, DIRECTED IN THE DIRECTION OF THE TELEPHONE TERMINAL OR COMPUTER FILE SERVER LOCATION. INSTALL A BUSHING ON THE CONDUIT. PLATES FOR THE OUTLETS SHALL BE PER 2.3.

PART 3 - EXECUTION

3.1 INSTALLATION
A. WIRING DEVICE BOXES AND PLATES, ETC., SHALL BE ACCURATELY SET PLUMB AND LEVEL. EXPOSED CONDUITS OR WIREMOLD SHALL BE RUN PARALLEL TO OR AT RIGHT ANGLES TO BUILDING LINES, HORIZONTAL RUNS LEVEL, AND VERTICAL LINES PLUMB.
B. UNLESS NOTED OTHERWISE, DEVICES SHALL BE MOUNTED AS FOLLOWS:
1. WALL MOUNTED SWITCHES: 48" ABOVE FINISHED FLOOR.
2. DUPLEX RECEPTACLES: 24" ABOVE FINISHED FLOOR, DUPLEX RECEPTACLES NOTED "C" SHALL BE MOUNTED HORIZONTALLY 6" ABOVE COUNTERTOPS.
C. ALL BOXES MOUNTED IN METAL STUD WALLS SHALL BE MOUNTED WITH APPROVED MOUNTING CLIPS AND CONDUITS SECURED WITH APPROVED CLIPS. 4" BOXES MOUNTED TO METAL STUDS SHALL HAVE FAR-SIDE BOX SUPPORTS.

SECTION 16170 - CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.1 GENERAL
A. EACH MOTOR OUTLET SHALL CONSIST OF A MOTOR DISCONNECT DEVICE, MOTOR RUNNING OVERCURRENT DEVICE FOR OVERLOADS, OR MOTOR CONTROL FOR THE MOTOR TO BE SERVED. ALL SHALL COMPLY WITH THE APPLICABLE PROVISIONS OF THE N.E.C. THE MOTOR RUNNING OVERCURRENT DEVICE MAY BE INCLUDED IN THE MOTOR CONTROLLER. THE DISCONNECT AND ISOLATION SWITCHES SHALL CONSIST OF THE FOLLOWING:
1. PROVIDE CIRCUIT BREAKERS OR SAFETY SWITCHES AS INDICATED OR REQUIRED, TO COMPLY WITH THE REQUIREMENTS OF N.E.C.
2. USE FUSELESS SAFETY SWITCHES FOR ISOLATION SWITCHES FOR ALL MOTORS EXCEPT MOTORS 1/3 H.P. OR LESS MAY BE ISOLATED BY TOGGLE SWITCHES, RATED AT LEAST TWICE THE AMPERE RATING OF THE MOTOR, OR BY FRACTIONAL HORSEPOWER MANUAL STARTERS AT THE MOTOR LOCATION.

PART 2 - PRODUCTS

2.1 GENERAL
A. SWITCHES SHALL BE SQUARE D, G.E., OR CHALLENGER.
B. SWITCHES SHALL BE TYPE HD, HEAVY DUTY SAFETY SWITCHES, QUICK-MAKE, QUICK-BREAK, SIDE OPERATED, SINGLE THROW, FUSIBLE GENERAL PURPOSE ENCLOSURE NEMA TYPE 1 FOR INDOOR LOCATIONS WITH NEMA TYPE 3R ENCLOSURES IN OUTSIDE LOCATIONS.
C. NEMA TYPES 4 AND 12 SWITCHES SHALL BE FURNISHED WERE INDICATED ON THE DRAWINGS.
D. NON-FUSED DISCONNECTS SHALL BE FURNISHED ONLY WHERE SPECIFICALLY INDICATED ON THE DRAWINGS.
E. ALL MOTOR DISCONNECTS SHALL HAVE ELECTRICAL INTERLOCKS FOR DISCONNECTING LINE VOLTAGE POWER TO MOTOR CONTROL CIRCUITS WHEN THE SWITCH IS OPENED.
F. DISCONNECT SWITCHES FOR ELECTRIC HEATING APPLIANCES SHALL BE EQUAL TO SQUARE D CLASS 2510/KG-1.

PART 3 - EXECUTION

3.1 SWITCH LOCATIONS
A. LOCATE SWITCHES AS INDICATED ON THE DRAWINGS.
B. LOCATIONS FOR DISCONNECT SWITCHES FOR ROOF TOP AND GROUND MOUNTED HVAC UNITS, CHILLERS, AND FANS INDICATED ON THE DRAWINGS ARE FOR REFERENCE ONLY. SWITCHES SHALL BE MOUNTED ON THE UNIT AT LOCATIONS AS RECOMMENDED BY THE UNIT MANUFACTURER.

3.2 SWITCH SIZES
A. SWITCHES SHALL BE SIZED AS INDICATED ON THE DRAWINGS. IF A SWITCH FOR A MOTOR OR OTHER ITEM OF MECHANICAL EQUIPMENT IS NOT SPECIFICALLY SIZED ON THE DRAWINGS, THE CONTRACTOR SHALL SIZE THE SWITCH RATED FOR THE SERVICE AND HORSEPOWER FOR THE EQUIPMENT OR MOTOR ACTUALLY INSTALLED. REFER TO THE MANUFACTURER'S DATA FOR SWITCH SIZING INFORMATION.

3.3 FUSES
A. FURNISH CLASS K DUAL ELEMENT FUSES, SIZED AS INDICATED OR AS REQUIRED BY EQUIPMENT SERVED.

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

4.1 CODES AND STANDARDS:
A. COMPLY WITH NFPA 70 "NATIONAL ELECTRICAL CODE."

PART 2 - PRODUCTS

5.1 ELECTRICAL IDENTIFICATION PRODUCTS:
A. UNDERGROUND LINE MARKING TAPE: PERMANENT, BRIGHT-COLORED, CONTINUOUS-PRINTED, PLASTIC TAPE COMPOUNDED FOR DIRECT-BURIAL SERVICE NOT LESS THAN 6 INCHES WIDE BY 4 MILS THICK. PRINTED LEGEND INDICATIVE OF GENERAL TYPE OF UNDERGROUND LINE BELOW.
B. WIRE/CABLE DESIGNATION TAPE MARKERS: VINYL OR VINYL CLOTH, SELF-ADHESIVE, WRAPAROUND, CABLE/CONDUCTOR MARKERS WITH PREPRINTED NUMBERS AND LETTER.
C. ENGRAVED, PLASTIC-LAMINATED LABELS, SIGNS, AND INSTRUCTION PLATES: ENGRAVING STOCK MELAMINE PLASTIC LAMINATE 1/16-INCH MINIMUM THICK FOR SIGNS UP TO 20 SQUARE INCHES, OR 8 INCHES IN LENGTH; 1/8-INCH THICK FOR LARGER SIZES. ENGRAVED LEGEND IN WHITE LETTERS ON BLACK FACE AND PUNCHED FOR MECHANICAL FASTENERS.
D. CABLE TIES: FUNGUS-INERT, SELF-EXTINGUISHING, ONE-PIECE, SELF- LOCKING NYLON CABLE TIES, 0.18-INCH MINIMUM WIDTH, 50-LB MINIMUM TENSILE STRENGTH, AND SUITABLE FOR A TEMPERATURE RANGE FROM MINUS 50 DEG F TO 350 DEG F. PROVIDE TIES IN SPECIFIED COLORS WHEN USED FOR COLOR CODING.
E. "DYMO" TYPE TAPE LABELS ARE NOT ACCEPTABLE FOR LABELING.

PART 3 - EXECUTION

6.1 GENERAL:
A. INSTALL IDENTIFICATION DEVICES IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS AND REQUIREMENTS OF NEC.
B. CONDUCTOR COLOR CODING: PROVIDE COLOR CODING FOR SECONDARY SERVICE, FEEDER, AND BRANCH CIRCUIT CONDUCTORS THROUGHOUT THE PROJECT SECONDARY ELECTRICAL SYSTEM AS FOLLOWS:

BLACK	PHASE A
RED	PHASE B
BLUE	PHASE C
WHITE	NEUTRAL
GREEN	GROUND

C. USE CONDUCTORS WITH COLOR FACTORY-APPLIED THE ENTIRE LENGTH OF THE CONDUCTORS EXCEPT AS FOLLOWS:
1. THE FOLLOWING FIELD-APPLIED COLOR-CODING METHODS MAY BE USED IN LIEU OF FACTORY-CODED WIRE FOR SIZES LARGER THAN NO. 10 AWG.
2. APPLY COLORED, PRESSURE-SENSITIVE PLASTIC TAPE IN HALF- LAPPED TURNS FOR A DISTANCE OF 6 INCHES FROM TERMINAL POINTS AND IN BOXES WHERE SPLICES OR TAPS ARE MADE. APPLY THE LAST TWO LAPS OF TAPE WITH NO TENSION TO PREVENT POSSIBLE UNWINDING. USE 1-INCH-WIDE TAPE IN COLORS AS SPECIFIED. DO NOT OBLITERATE CABLE IDENTIFICATION MARKINGS BY TAPING. TAPE LOCATIONS MAY BE ADJUSTED SLIGHTLY TO PREVENT SUCH OBLITERATION.
3. IN LIEU OF PRESSURE-SENSITIVE TAPE, COLORED CABLE TIES MAY BE USED FOR COLOR IDENTIFICATION. APPLY THREE TIES OF SPECIFIED COLOR TO EACH WIRE AT EACH TERMINAL OR SPLICE POINT STARTING 3 INCHES FROM THE TERMINAL AND SPACED 3 INCHES APART. APPLY WITH A SPECIAL TOOL OR PLIERS, TIGHTEN FOR SNUG FIT, AND CUT OFF EXCESS LENGTH.
D. APPLY EQUIPMENT IDENTIFICATION LABELS OF ENGRAVED PLASTIC-LAMINATE ON PANELBOARDS. EXCEPT AS OTHERWISE INDICATED, PROVIDE SINGLE LINE OF TEXT, WITH 1/2-INCH-HIGH LETTERING ON 1-1/2-INCH-HIGH LABEL (2-INCH-HIGH WHERE TWO LINES ARE REQUIRED), WHITE LETTERING IN BLACK FIELD. TEXT SHALL MATCH TERMINOLOGY AND NUMBERING OF THE CONTRACT DOCUMENTS AND SHOP DRAWINGS.

SECTION 16452 - GROUNDING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:
A. ELECTRICAL COMPONENT STANDARD: NFPA 70, "NATIONAL ELECTRICAL CODE" FOR COMPONENTS AND INSTALLATION.
B. UL STANDARD: UL STANDARD 467, "GROUNDING AND BONDING EQUIPMENT."

PART 2 - PRODUCTS
A. GROUNDING AND BONDING PRODUCTS: TYPES AS INDICATED. WHERE TYPES, SIZES, RATINGS, AND QUANTITIES INDICATED DIFFER FROM NEC REQUIREMENTS, THE MORE STRINGENT REQUIREMENTS AND THE GREATER SIZE, RATING, AND QUANTITY INDICATIONS GOVERN.
B. CONDUCTOR MATERIALS: COPPER.
C. WIRE AND CABLE CONDUCTORS: COMPLY WITH DIVISION 16 SECTION "WIRES AND CABLES." CONFORM TO NEC TABLE 8, EXCEPT AS OTHERWISE INDICATED, FOR CONDUCTOR PROPERTIES, INCLUDING STRANDING.
D. EQUIPMENT GROUNDING CONDUCTOR: GREEN INSULATED.
E. GROUNDING ELECTRODE CONDUCTOR: STRANDED CABLE.
F. BARE COPPER CONDUCTORS: CONFORM TO ASTM B-3.
G. BRAIDED BONDING JUMPERS: COPPER TAPE, BRAIDED FROM NO. 30-GAGE BARE COPPER WIRE AND TERMINATED WITH COPPER FERRULES.
H. CONNECTOR PRODUCTS: LISTED AND LABELED AS GROUNDING CONNECTORS FOR THE MATERIALS WITH WHICH USED.
I. PRESSURE CONNECTORS: HIGH-CONDUCTIVITY PLATED UNITS.
J. BOLTED CLAMPS: HEAVY-DUTY UNITS LISTED FOR THE APPLICATION.
K. EXOTHERMIC WELDED CONNECTIONS: PROVIDED IN KIT FORM AND SELECTED FOR THE SPECIFIC TYPES, SIZES, AND COMBINATIONS OF CONDUCTORS AND OTHER ITEMS TO BE CONNECTED.
L. GROUND RODS: COPPER-CLAD STEEL, 5/8 INCH BY 10 FEET, MINIMUM.

PART 3 - EXECUTION

3.1 INSTALLATION:
A. EQUIPMENT GROUNDING CONDUCTOR APPLICATION: COMPLY WITH NEC ARTICLE 250 FOR SIZES AND QUANTITIES OF EQUIPMENT GROUNDING CONDUCTORS, EXCEPT WHERE LARGER SIZES OR MORE CONDUCTORS ARE INDICATED.
B. GROUND RODS: LOCATE A MINIMUM OF ONE-ROD LENGTH FROM EACH OTHER AND AT LEAST THE SAME DISTANCE FROM ANY OTHER GROUNDING ELECTRODE. INTERCONNECT GROUND RODS WITH BARE CONDUCTORS BURIED AT LEAST 24 INCHES BELOW GRADE. CONNECT BARE-CABLE GROUND CONDUCTORS TO GROUND RODS BY MEANS OF EXOTHERMIC WELDS EXCEPT AS OTHERWISE INDICATED. MAKE THESE CONNECTIONS WITHOUT DAMAGING THE COPPER COATING OR EXPOSING THE STEEL. DRIVE RODS UNTIL TOPS ARE 6 INCHES BELOW FINISHED FLOOR OR FINAL GRADE EXCEPT AS OTHERWISE INDICATED.
C. GROUNDING ELECTRODE CONDUCTOR: PROVIDE INSULATED COPPER CONDUCTOR, SIZED AS INDICATED, IN CONDUIT. BOND THE GROUND CONDUCTOR CONDUIT TO THE CONDUCTOR AT EACH END. WHERE A DIELECTRIC FITTING IS INSTALLED IN THE MAIN METALLIC WATER SERVICE PIPE, CONNECT THE GROUND CONDUCTOR TO THE STREET SIDE OF THE FITTING. DO NOT INSTALL A GROUNDING JUMPER AROUND DIELECTRIC FITTINGS. BOND THE GROUND CONDUCTOR CONDUIT TO THE CONDUCTOR AT EACH END.
D. BRAIDED-TYPE BONDING JUMPERS: INSTALL TO CONNECT GROUND CLAMPS ON WATER METER PIPING TO ELECTRICALLY BYPASS WATER METERS. USE ELSEWHERE FOR FLEXIBLE BONDING AND GROUNDING CONNECTIONS.
E. ROUTE GROUNDING AND BONDING CONDUCTORS USING THE SHORTEST AND STRAIGHTEST PATHS POSSIBLE WITHOUT OBSTRUCTING ACCESS OR PLACING CONDUCTORS WHERE THEY MAY BE SUBJECTED TO STRAIN, IMPACT, OR DAMAGE, EXCEPT AS INDICATED.
F. CONNECTIONS: MAKE CONNECTIONS IN SUCH A MANNER AS TO MINIMIZE POSSIBILITY OF GALVANIC ACTION OR ELECTROLYSIS. SELECT CONNECTORS, CONNECTION HARDWARE, CONDUCTORS, AND CONNECTION METHODS SO METALS IN DIRECT CONTACT WILL BE GALVANICALLY COMPATIBLE.
1. USE ELECTROPLATED OR HOT-TIN-COATED MATERIALS TO ASSURE HIGH CONDUCTIVITY AND MAKE POINTS OF CONTACT CLOSER IN ORDER OF GALVANIC SERIES.
2. MAKE CONNECTIONS WITH CLEAN BARE METAL AT POINTS OF CONTACT.
3. COAT AND SEAL CONNECTIONS INVOLVING DISSIMILAR METALS WITH INERT MATERIAL SUCH AS RED LEAD PAINT TO PREVENT PENETRATION OF MOISTURE TO CONTACT SURFACES.
G. EXOTHERMIC WELDED CONNECTIONS: USE FOR CONNECTIONS TO STRUCTURAL STEEL AND FOR UNDERGROUND CONNECTIONS EXCEPT THOSE AT TEST WELLS. INSTALL AT CONNECTIONS TO GROUND RODS AND PLATE ELECTRODES. COMPLY WITH MANUFACTURER'S WRITTEN RECOMMENDATIONS. WELDS THAT ARE PUFFED UP OR THAT SHOW CONVEX SURFACES INDICATING IMPROPER CLEANING ARE NOT ACCEPTABLE.
H. TIGHTEN GROUNDING AND BONDING CONNECTORS AND TERMINALS, INCLUDING SCREWS AND BOLTS, IN ACCORDANCE WITH MANUFACTURER'S PUBLISHED TORQUE TIGHTENING VALUES FOR CONNECTORS AND BOLTS.
I. GROUND/RESISTANCE MAXIMUM VALUES SHALL BE 10 OHMS.

SECTION 16470 - PANELBOARDS & LOAD CENTERS

PART 1 - GENERAL

1.1 MATERIALS SHALL BE NEW AND A STANDARD CATALOGED PRODUCT OF THE MANUFACTURER.

PART 2 - PRODUCTS

2.1 PANELBOARDS & LOAD CENTERS
A. CIRCUIT BREAKER PANELBOARDS SHALL BE AS SHOWN IN THE SCHEDULE WITH: DEAD-FRONT CONSTRUCTION, COPPER BUS BARS, CONCEALED TRIM CLAMPS, GRAY ENAMEL CODE GAUGE STEEL FRONTS AND DOORS WITH FLUSH HINGES AND SEMIFLUSH CATCH AND LOCKS. CABINETS SHALL BE CODE GAUGE GALVANIZED STEEL. LOAD CENTER TYPE CONSTRUCTION WILL BE ACCEPTABLE WHERE APPROVED BY LOCAL CODES.
B. PANELBOARDS SHALL BE FURNISHED WITH ALL ACCESSORIES AS NOTED IN THE PANELBOARD SCHEDULE AND SPECIFIED HEREIN.
C. PANELBOARDS SHALL MEET FEDERAL SPECIFICATION #W-P-115A, TYPE 1, CLASS 1, AND UL67 AND UL50 REQUIREMENTS.

2.2 CIRCUIT BREAKERS
A. CIRCUIT BREAKERS SHALL COMPLY WITH FEDERAL SPECIFICATION WC-375B AND SHALL BE MOLDED CASE, BOLT-ON, QUICK-MAKE, QUICK-BREAK THERMAL MAGNETIC; WITH ON, OFF AND TRIPPED POSITIONS. TWO AND THREE POLE BREAKERS SHALL BE COMMON TRIP.
B. CIRCUIT BREAKERS SERVING HEATING AND AIR CONDITIONING EQUIPMENT SHALL BE HACR RATED BREAKERS. BREAKERS SERVING FLUORESCENT AND HID LIGHTING LOADS SHALL BE HID RATED.
C. CIRCUIT BREAKERS 400 AMPS AND LARGER SIZES SHALL BE INTERCHANGEABLE TRIP TYPE BREAKERS.
D. OTHER TYPES AND INTERRUPTING RATINGS OF BREAKERS SHALL BE AS NOTED IN THE PANELBOARD SCHEDULE.

2.3 MANUFACTURERS
A. PANELBOARDS SHALL BE SQUARE D. EQUIPMENT AS MANUFACTURED BY GENERAL ELECTRIC, ITE, SIEMENS, OR CHALLENGER WILL BE ACCEPTABLE PROVIDED THEY MEET ALL REQUIREMENTS OF THIS SPECIFICATION.

PART 3 - EXECUTION

3.1 INSTALLATION
A. PANELBOARD BOXES AND TRIMS SHALL BE INSTALLED ACCURATELY AND SET PLUMB AND LEVEL AND IN ACCORDANCE WITH THE MANUFACTURER MOUNTING INSTRUCTIONS.
B. FLUSH MOUNTED PANELBOARDS SHALL HAVE TWO (2) ONE INCH EMPTY CONDUITS EXTENDED FROM THE PANELBOARD INTO ACCESSIBLE CEILING SPACE, TERMINATING IN A 6" X 6" X 4" PULL BOX WITH SCREW COVER FOR FUTURE USE.
C. ALL PANELBOARD INDEX CARDS SHALL BE NEATLY FILLED IN WITH TYPEWRITER OR WORD PROCESSOR AND SHALL DESCRIBE THE LOADS SERVED BY EACH CIRCUIT PROTECTIVE DEVICE. HAND WRITTEN INDEX CARDS ARE NOT ACCEPTABLE. REFER TO SECTION 16195.

3.2 ELECTRICAL LOAD BALANCE
A. CONNECT BRANCH AND FEEDER CIRCUITS TO PANELBOARDS IN SUCH A MANNER AS TO BALANCE, AS EQUALLY AS POSSIBLE, THE LOADS CONNECTED TO EACH PHASE. AT THE COMPLETION OF THE WORK, CHECK THE LOAD CURRENT IN EACH PHASE OF EACH FEEDER AND MAKE ADJUSTMENTS AS NECESSARY TO CORRECT LOAD UNBALANCES.

SECTION 16481 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 MATERIALS
A. MATERIALS SHALL BE NEW AND A STANDARD CATALOGED PRODUCT OF THE MANUFACTURER.

PART 2 - PRODUCTS
A. MANUAL MOTOR STARTERS
1. MANUAL MOTOR STARTERS FOR FRACTIONAL HORSE-POWER SINGLE PHASE MOTORS SHALL BE G.E. [illegible] WITH CR123 OVERLOAD HEATERS SIZED TO PROTECT THE MOTOR SERVED.
B. EQUAL STARTERS AS MANUFACTURED BY SQUARE D, G.E. OR ALLEN BRADLEY WILL BE ACCEPTABLE.

PART 3 - EXECUTION

3.1 INSTALLATION
A. MOTOR STARTERS SHALL BE FURNISHED BY THIS CONTRACTOR WHERE INDICATED ON THE PLANS AND IN GENERAL SHALL BE LOCATED IN THE SAME AMBIENT TEMPERATURE AS THE MOTOR. STARTERS LOCATED INDOORS SHALL BE IN NEMA-1 ENCLOSURES. STARTERS LOCATED OUTDOORS SHALL BE IN WATER AND DUST TIGHT ENCLOSURES NEMA-4.

SECTION 16515 - LIGHTING FIXTURES AND LAMPS

PART 1 - GENERAL

1.1 MATERIALS
A. MATERIALS SHALL BE NEW AND A STANDARD CATALOGED PRODUCT OF THE MANUFACTURER. EXPERIMENTAL OR UNPROVEN DESIGNS WILL NOT BE ACCEPTABLE.
B. MANUFACTURER:
1. PROVIDE PRODUCTS AS SUPPLIED BY:
a. GE SUPPLY, 405-507-0489.
b. AMERICAN LIGHTING, 800-880-8881.

PART 2 - PRODUCTS

2.1 GENERAL
A. LIGHTING FIXTURES SHALL BEAR THE LABEL OF UNDERWRITER'S LABORATORIES, INC., APPROPRIATE FOR THE SERVICE IN WHICH THEY ARE TO BE INSTALLED.
B. LIGHTING FIXTURES NUMBERS SHOWN ON PLANS REFER TO FIXTURE TYPE NUMBERS AND/OR LETTERS SHOWN ON THE "LIGHTING FIXTURE SCHEDULE" ON THE DRAWINGS.
C. FLUORESCENT FIXTURES SHALL BE IN ACCORDANCE WITH THE FIXTURE SCHEDULE AND AS FOLLOWS:
1. ALL FIXTURE FINISHES SHALL BE FACTORY APPLIED AFTER THE FIXTURE IS FABRICATED. NO PRE-PAINTED FIXTURE BODIES OR PARTS ARE ACCEPTABLE.
2. FINISHED INTERIOR HOUSING SHALL HAVE A MINIMUM REFLECTANCE OF 90%.
3. FIXTURES SHALL BE DESIGNED TO OPERATE CONTINUOUSLY AT 27 DEGREES C. SPACE AMBIENT AT 5% ABOVE NOMINAL VOLTAGE.
4. FIXTURES SHALL BE TESTED BY A RECOGNIZED LABORATORY FOR CONFORMANCE WITH THE ABOVE RE-QUIREMENTS AND COPIES OF CERTIFIED TEST DATA SHALL BE SUBMITTED FOR APPROVAL. FIXTURES INSTALLED ON THE PROJECT SHALL BE IDENTICAL IN EVERY RESPECT TO THE FIXTURES SUBMITTED AND APPROVED.
5. WHERE ACRYLIC LENSES ARE SPECIFIED, LENSES SHALL BE PATTERN 12, VIRGIN ACRYLIC WITH A NOMINAL THICKNESS OF 0.125".
6. FLUORESCENT BALLASTS SHALL BE ELECTRONIC TYPE, LOW HARMONIC, RAPID START, UL LISTED, CLASS A SOUND RATED, IN COMPLIANCE WITH FCC PART 18 FOR EMI AND RFI, MINIMUM FREQUENCY OF 20,000 HZ, MAXIMUM 1.7 CREST FACTOR, MINIMUM 90% POWER FACTOR, THD LESS THAN 25%, MAXIMUM LAMP FLICKER 10%, MINIMUM 3 YEAR WARRANTY WITH LABOR ALLOWANCE. BALLASTS SHALL BE FOR THE VOLTAGE AS INDICATED IN THE LIGHTING FIXTURE SCHEDULE. BALLASTS AS MANUFACTURED BY ADVANCE, EBT, MAGNETEK/TRIAD, MOTOROLA, AND VALMONT WILL BE ACCEPTABLE PROVIDED THEY MEET THE ALL OF THE REQUIREMENTS STATED HEREIN.
D. FLUORESCENT FIXTURES SHALL BE FURNISHED WITH SELF CONTAINED EMERGENCY POWER BATTERY PACKS WHERE SHOWN IN THE "LIGHTING FIXTURE SCHEDULE" AND INDICATED ON THE DRAWINGS. POWER PACKS SHALL HAVE FIELD REPLACEABLE NICAD BATTERY CAPABLE OF OPERATING ONE LAMP AT A MINIMUM OF 33% OF FULL LIGHT OUTPUT FOR 90 MINUTES. POWER PACKS SHALL BE FACTORY MOUNTED IN THE BALLAST CHANNEL WITH BATTERY CHARGE INDICATOR LIGHTS AND TEST SWITCH.
E. LIGHTING FIXTURES SHALL BE FURNISHED COMPLETE WITH PLASTER FRAMES WHERE REQUIRED BY ROOM FINISH. LAY-IN TYPE FIXTURES INSTALLED IN GRID CEILINGS SHALL BE FURNISHED WITH FOUR (4) HOLD DOWN CLIPS.

2.2 LAMPS
A. EACH LIGHTING FIXTURE SHALL BE FURNISHED COMPLETE WITH LAMPS. LAMPS SHALL BE AS MANUFACTURED BY GENERAL ELECTRIC, PHILLIPS, OR OSRAM AND SIZED IN ACCORDANCE WITH THE FIXTURE SCHEDULE AS FOLLOWS.
1. F40T12 FOUR FOOT FLUORESCENT LAMPS SHALL BE G.E. F40SPX35/RS/WM, 3500 DEGREE K, 82 CRI, "WATT-MISER" OR EQUAL, UNLESS NOTED OTHERWISE.
2. F32T8 FOUR FOOT FLUORESCENT LAMPS SHALL BE G.E. F32T8/SPX35 OR EQUAL UNLESS NOTED OTHERWISE.
3. COMPACT FLUORESCENT LAMPS SHALL BE G.E. "BIAX", 3500 DEGREE K, CRI 82 UNLESS NOTED OTHERWISE.
4. INCANDESCENT LAMPS SHALL BE RATED AT 120 VOLTS.
5. ALL OTHER LAMPS SHALL BE AS INDICATED IN THE "LIGHTING FIXTURE SCHEDULE".

2.3 EXIT SIGNS
A. EXIT SIGNS ARE SPECIFIED IN THE "LIGHTING FIXTURE SCHEDULE". SIGNS SHALL BE FURNISHED WITH SELF CONTAINED EMERGENCY POWER BATTERY PACKS. POWER PACKS SHALL HAVE FIELD REPLACEABLE NICAD BATTERY CAPABLE OF OPERATING THE SIGN AT FULL LIGHT OUTPUT FOR 90 MINUTES. POWER PACKS SHALL BE FACTORY MOUNTED IN THE SIGNS. LAMPS, LEDS, OR ELECTROLUMINANCE PANELS SHALL BE AS SPECIFIED FOR THE SIGN.
B. FINISH OF EXIT SIGNS SHALL BE AS INDICATED IN THE "LIGHTING FIXTURE SCHEDULE".
C. SIGNS SHALL BE FURNISHED WITH DIRECTIONAL ARROWS AS INDICATED ON THE DRAWINGS.

2.4 MENU LIGHTING
A. LOW VOLTAGE 12V. (OPTION) IF LOW VOLTAGE IS REQUIRED BY OWNER OR BY LOCAL CODES FOR USE IN STEEL TUBING THE FOLLOWING SHOULD BE USED: STANDARD 115V WIRING AS SPECIFIED. CIRCUITS AS SHOWN STANDARD ON PLANS. TRANSFORMER ON EACH CIRCUIT. (40T8.5 40V)

2.5 CANOPY "PUCK" LIGHTS
A. MANUFACTURER:
1. PROVIDE PRODUCTS AS SUPPLIED BY:
a. GE SUPPLY, 303-572-7124.
b. AMERICAN LIGHTING, 800-880-8881.

2.6 CEILING FANS
A. MANUFACTURER:
1. PROVIDE PRODUCTS SUPPLIED BY AMERICAN LIGHTING, 800-880-8881.

PART 3 - EXECUTION

3.1 INSTALLATION OF INTERIOR FIXTURES
A. REFER TO ARCHITECTURAL REFLECTED CEILING PLAN(S) FOR EXACT LOCATIONS OF CEILING MOUNTED LIGHTING FIXTURES.
B. COORDINATE FIXTURE LOCATIONS WITH OTHER CEILING MOUNTED MECHANICAL AND ELECTRICAL DEVICES. IF THE FIXTURE CANNOT BE INSTALLED WHERE INDICATED DUE TO ANY OBSTRUCTION, THE CONTRACTOR SHALL MOVE THE FIXTURE UP TO EIGHT (8) FEET IN ANY DIRECTION DIRECTED PRIOR TO IT'S INSTALLATION WITHOUT ADDITIONAL COST TO THE OWNER.
C. EACH LAY-IN TROFFER MOUNTED IN T-BAR CEILINGS SHALL BE INSTALLED WITH FOUR (4) HOLD DOWN CLIPS.
D. RECESSED INCANDESCENT AND COMPACT FLUORESCENT FIXTURES MOUNTED IN CEILING TILES SHALL BE FURNISHED WITH METAL BARS TO SUPPORT THE FIXTURE FROM THE CEILING SUSPENSION MEMBERS.
E. OUTLET BOXES FOR SURFACE MOUNTED FIXTURES SHALL HAVE BOX SUPPORTS ATTACHED TO THE CEILING SUPPORTING MEMBERS.
F. INSTALL FIXTURES WITH FINISHING FRAMES FIRMLY TO THE CEILING AND FURNISH GASKETS AS NECESSARY TO PREVENT LIGHT LEAKS.
G. EXIT SIGNS SHALL BE FIRMLY MOUNTED TO THE CEILINGS OR WALLS AS SPECIFIED.
H. INSTALL LAY-IN TROFFERS WITH MINIMUM OF 5 FT. FLEXIBLE CONDUIT WHIPS.
I. PRIOR TO THE PROJECT COMPLETION INSPECTION, THE CONTRACTOR SHALL CLEAN THE CONSTRUCTION DUST AND OTHER DEBRIS FROM THE LAMPS AND THE INSIDE AND OUTSIDE OF THE FIXTURE SURFACES AND LENSES. ANY SCRATCHES OR BLEMISHES IN FIXTURE PAINTED FINISHES SHALL BE TOUCHED UP IN MATCHING PAINT. ANY BURNED-OUT LAMPS SHALL BE REPLACED.

3.2 INSTALLATION OF EXTERIOR FIXTURES
A. SUPPORT FIXTURES IN ACCORDANCE WITH STANDARDS OF PRACTICE FOR FIXTURE TYPE & LOCATION.
B. COORDINATE FIXTURE LOCATIONS ARCHITECTURAL AND SITE FEATURES. IF THE FIXTURE CANNOT BE INSTALLED WHERE INDICATED DUE TO ANY OBSTRUCTION OR SITE LIMITATION, THE CONTRACTOR SHALL MOVE THE FIXTURE UP TO TWELVE (12) FEET IN ANY DIRECTION DIRECTED PRIOR TO IT'S INSTALLATION WITHOUT ADDITIONAL COST TO THE OWNER.
C. INSTALL WITH GASKETS AS REQUIRED TO PREVENT MOISTURE AND INSECTS FROM ENTERING THE FIXTURES.
D. PRIOR TO THE PROJECT COMPLETION INSPECTION, THE CONTRACTOR SHALL:
1. CLEAN THE CONSTRUCTION DUST, INSECTS, AND OTHER DEBRIS FROM THE LAMPS AND THE INSIDE AND OUTSIDE OF THE FIXTURE SURFACES AND LENSES.
2. TOUCH UP ANY SCRATCHES OR BLEMISHES IN FIXTURE PAINTED FINISHES IN MATCHING PAINT. SCRATCHES IN ANODIZED OR DURANOTIC FINISHES SHALL BE REPAIRED OR PART SHALL BE REPLACED AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
3. REPLACE ALL BURNED-OUT LAMPS.

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SEAL: GREGORY M. STEINMETZ Lic. No. 48806 PROFESSIONAL ENGINEER
Digitally signed by Gregory M Steinmetz Date: 2018.07.27 13:06:24-05'00'
COMMONWEALTH OF VIRGINIA Lic. No. 402048820 PROFESSIONAL ENGINEER
Digitally signed by Jay D Rohkohl Date: 2018.07.27 13:13:24-05'00'

PROJECT NO.: 0419739-002
DRAWN BY: TAB
CHECKED BY: GS

ISSUE:	DATE:
PERMIT SET	07-27-18

REVISION:	DATE:

PROJECT LOCATION:
MANASSAS, VA
#6711

SHEET NUMBER / TITLE:
SP6.0
SPECIFICATIONS