





**ELECTRICAL SPECIFICATIONS**

**PART 1 – GENERAL PROVISIONS FOR ELECTRICAL WORK**

**REFERENCES**

THIS SECTION COVERS THE GENERAL REQUIREMENTS FOR ELECTRICAL WORK. EXAMINE ALL CONTRACT DRAWINGS AND ALL OTHER SECTIONS OF THE SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO THE WORK OF THIS DIVISION.

**DEFINITIONS**

"PROVIDE" – TO FURNISH, INSTALL AND CONNECT UP COMPLETE AND READY FOR SAFE AND REGULAR OPERATION OF PARTICULAR WORK REFERRED TO UNLESS, SPECIFICALLY OTHERWISE NOTED.

"INSTALL" – TO ERECT, MOUNT AND CONNECT COMPLETE WITH RELATED ACCESSORIES.

"WORK" – LABOR, MATERIALS, EQUIPMENT, APPARATUS, CONTROLS, ACCESSORIES AND OTHER ITEMS REQUIRED FOR PROPER AND COMPLETE INSTALLATION.

"WIRING" – RACEWAY, FITTINGS, WIRE, BOXES, MOUNTING HARDWARE AND RELATED ITEMS.

"CONCEALED" – EMBEDDED IN MASONRY OR OTHER CONSTRUCTION CAVITY, INSTALLED IN FURRED SPACES, WITHIN DOUBLE PARTITIONS OR HUNG CEILINGS.

"SIMILAR" OR "EQUAL" – EQUAL MATERIALS, WEIGHT, SIZE, DESIGN AND EFFICIENCY OF SPECIFIED PRODUCT.

"CONTRACTOR" – THE ELECTRICAL CONTRACTOR.

"NOTED" – AS INDICATED ON THE DRAWINGS AND/OR SPECIFICATIONS.

**SCOPE**

THIS WORK SHALL CONSIST OF THE FURNISHINGS OF ALL LABOR, MATERIALS AND SERVICES REQUIRED COMPLETE, READY FOR CORRECT OPERATION FOR ALL ELECTRICAL WORK CALL FOR BY THE ACCOMPANYING DRAWINGS AND SPECIFICATIONS. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, STATE AND LOCAL CODES.

THE DATA INDICATED IN THESE DRAWINGS AND SPECIFICATIONS ARE AS EXACT AS CAN BE SECURED. BUT THEIR ABSOLUTE ACCURACY IS NOT GUARANTEED. DO NOT SCALE DRAWINGS. EXACT LOCATIONS, DISTANCES, LEVELS AND OTHER CONDITIONS WILL BE GOVERNED BY THE BUILDING. USE THE DRAWINGS AND SPECIFICATIONS FOR GUIDANCE AND SECURE THE ENGINEER'S APPROVAL OF CHANGES IN LOCATIONS, CIRCUITS, WHERE SHOWN ON AN ELECTRICAL DRAWING, ARE SO INDICATED PRIMARILY FOR THE PURPOSE OF INDICATING THE GENERAL CIRCUIT PLAN AND DO NOT NECESSARILY INDICATE THE EXACT LOCATION OF ROUTING OF THE RACEWAYS UNLESS SPECIFICALLY INDICATED. CIRCUITS SHALL BE RUN IN SUIT CONDITIONS CONSIDERING STRUCTURAL FEATURES, OTHER TRADES, CONSTRUCTION METHODS AND GOOD INSTALLATION PRACTICE.

BEFORE SUBMITTING A BID, THE CONTRACTOR SHALL VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH ALL EXISTING CONDITIONS UNDER WHICH THE WORK AND WORK OF OTHER TRADES WILL BE INSTALLED. THIS CONTRACT INCLUDES ALL NECESSARY OFFSETS, TRANSITIONS, MODIFICATIONS AND RELOCATION REQUIRED TO INSTALL ALL NEW EQUIPMENT IN NEW EXISTING SPACES. CONTRACTOR SHALL INCLUDE ANY MODIFICATIONS REQUIRED IN EXISTING ELECTRICAL EQUIPMENT FOR INSTALLATION OF NEW ELECTRICAL EQUIPMENT AND NEW EQUIPMENT OF OTHER TRADES, (LIGHTING FIXTURES, DEVICES, CONDUIT WIRING, ETC.) ALL NEW AND EXISTING EQUIPMENT AND SYSTEMS SHALL BE FULLY OPERATIONAL UNDER THIS CONTRACT BEFORE THE PROJECT IS CONSIDERED COMPLETE. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY ASSUMPTIONS THAT ARE MADE, ANY OMISSIONS OR ERRORS MADE AS A RESULT OF HIS VISIT TO THE SITE AND BECOME THOROUGHLY FAMILIAR WITH THE EXISTING CONDITIONS AND THE CONTRACT DOCUMENTS OF ALL TRADES.

**CODES, REGULATIONS AND STANDARDS**

ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING APPROVED CODES:

- STATE DEMOLITION CODE
- STATE BUILDING CODE
- STATE FIRE SAFETY CODE
- LOCAL BUILDING CODE
- IBC – INTERNATIONAL BUILDING CODE
- NFPA – NATIONAL FIRE PROTECTION CODE
- ANSI – AMERICAN NATIONAL STANDARDS INSTITUTE
- ASTM – AMERICAN SOCIETY FOR TESTING AND MATERIALS
- OSHA – OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
- U.L. – UNDERWRITERS LABORATORIES
- NFPA 101 – LIFE SAFETY CODE
- NFPA 70 – NATIONAL ELECTRICAL CODE
- NFPA 72 – NATIONAL FIRE ALARM CODE
- EPA – ENVIRONMENTAL PROTECTION AGENCY
- IEEE – INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
- NEMA – NATIONAL ELECTRICAL MANUFACTURING ASSOCIATION
- IECC – INTERNATIONAL ENERGY CONSERVATION CODE.

**PERMITS, FEES AND INSPECTIONS**

THE CONTRACTOR SHALL GIVE ALL NECESSARY NOTICES, OBTAIN ALL PERMITS, PAY FOR ALL GOVERNMENT, STATE SALES TAXES AND APPLICABLE FEES. THE CONTRACTOR SHALL FILE ALL DRAWINGS, COMPLETE ALL DOCUMENTS AND OBTAIN ALL NECESSARY APPROVALS FROM THE PROPER AUTHORITY OR AGENCY HAVING JURISDICTION. OBTAIN ALL REQUIRED CERTIFICATES OF INSPECTION COVERING WORK. THE CONTRACTOR SHALL SEE THAT ALL REQUIRED INSPECTIONS AND TESTS ARE MADE AND SHALL COOPERATE TO MAKE THESE TESTS AS THOROUGH AND AS READILY MADE AS POSSIBLE.

**MATERIALS AND WORKMANSHIP**

ALL MATERIALS AND APPARATUS REQUIRED FOR THE WORK, EXCEPT AS OTHERWISE SPECIFIED, SHALL BE NEW AND OF FIRST-CLASS QUALITY. IT SHALL BE FURNISHED DELIVERED, ERECTED, CONNECTED, FINISHED IN EVERY DETAIL AND SO SELECTED AND ARRANGED AS TO FIT PROPERLY INTO THE BUILDING SPACES. WHERE NO SPECIFIC KIND OR QUALITY MATERIAL IS GIVEN, A FIRST-CLASS STANDARD ARTICLE AS ACCEPTED BY THE ENGINEER SHALL BE FURNISHED.

ALL EQUIPMENT AND MATERIALS SHALL BE SPECIFICATION GRADE AND BEAR THE UNDERWRITER'S LABEL. NO SUBSTITUTE OR ALTERNATE EQUIPMENT, MATERIAL, ETC. WILL BE CONSIDERED FOR THIS PROJECT.

ALL WORK SHALL BE OF A QUALITY CONSISTENT WITH GOOD TRADE PRACTICE AND SHALL BE INSTALLED IN A NEAT WORKMANLIKE MANNER. THE ENGINEER/OWNER RESERVES THE RIGHT TO REJECT ANY WORK WHICH, IN HIS OPINION, HAS BEEN INSTALLED IN A SUBSTANDARD, DANGEROUS OR IN A UNSERVICEABLE MANNER. THE CONTRACTOR SHALL REPLACE REJECTED WORK IN A SATISFACTORY MANNER AT NO EXTRA COST TO THE OWNER.

**GUARANTEES**

ALL WORKMANSHIP AND MATERIALS SHALL BE FULLY GUARANTEED FOR A PERIOD OF ONE YEAR AFTER ACCEPTANCE OF THE ENTIRE INSTALLATION COVERED BY THIS CONTRACT. SHOULD ANY DEFECTS OCCUR DURING THE GUARANTEED PERIOD, THE CONTRACTOR SHALL REPAIR AND/OR REPLACE ALL DEFECTIVE EQUIPMENT, MATERIAL AND/OR WORK AT NO EXTRA COST TO THE OWNER.

**RECORD DRAWINGS**

MAINTAIN, AT THE JOB SITE, A SET OF ELECTRICAL DRAWINGS INDICATING ALL CHANGES IN LOCATION AND CIRCUITING OF THE EQUIPMENT, PANELS, DEVICES, ETC. FROM THE ORIGINAL LAYOUT. CLEARLY MARK IN RED ALL CHANGES ON THE DRAWINGS. AT THE COMPLETION OF THE PROJECT THE CONTRACTOR SHALL TURN OVER THE RECORD DRAWINGS TO THE ENGINEER/OWNER.

**COORDINATION**

ALL WORK SHALL BE COORDINATED AND CARRIED OUT IN CONJUNCTION WITH ALL TRADES AND FULL COORDINATION DRAWINGS SHALL BE CREATED IN ORDER THAT ALL WORK MAY PROCEED WITH A MINIMUM OF DELAY AND INTERFERENCE.

**SHOP DRAWINGS**

SUBMIT EIGHT (8) COPIES FOR REVIEW, DETAILED SHOP DRAWINGS OF ALL EQUIPMENT AND MATERIAL SPECIFIED. THE CONTRACTOR SHALL REVIEW ALL SHOP DRAWINGS PRIOR TO SUBMISSION TO THE ENGINEER FOR REVIEW. NO MATERIAL OR EQUIPMENT MAY BE DELIVERED TO THE JOB SITE OR INSTALLED UNTIL CONTRACTOR HAS IN THEIR POSSESSION, APPROVED SHOP DRAWINGS FOR THE PARTICULAR MATERIAL OR EQUIPMENT. SHOP DRAWINGS SHALL BE SPECIFIC WITH ITEMS SUBMITTED FOR APPROVAL CLEARLY IDENTIFIED.

THE FOLLOWING IS A LIST OF ELECTRICAL ITEMS THAT MUST BE SUBMITTED FOR REVIEW:

- a. SERVICE ENTRANCE CABINET
- b. PANEL BOARDS
- c. CIRCUIT BREAKERS
- d. FUSES
- e. CONDUIT, WIRE AND CABLE

**OPERATING INSTRUCTIONS**

THE CONTRACTOR SHALL FURNISH TO THE ENGINEER, FOUR (4) COMPLETE BOUND SETS OF TYPEWRITTEN OR BLUEPRINTED INSTRUCTIONS FOR OPERATING AND MAINTAINING ALL SYSTEMS AND EQUIPMENT INCLUDED IN THIS DIVISION. MANUFACTURER'S ADVERTISING LITERATURE OR CATALOGS WILL NOT BE ACCEPTABLE FOR OPERATING AND MAINTENANCE INSTRUCTIONS.

THE CONTRACTOR, IN THE ABOVE-MENTIONED INSTRUCTIONS, SHALL INCLUDE THE MAINTENANCE SCHEDULE FOR THE PRINCIPAL ITEMS OF EQUIPMENT FURNISHED UNDER THIS DIVISION.

AN AUTHORIZED MANUFACTURER'S REPRESENTATIVE SHALL ATTEST IN WRITING THAT HIS EQUIPMENT HAS BEEN PROPERLY INSTALLED PRIOR TO STARTUP. THESE LETTERS WILL BE BOUND INTO OPERATING AND MAINTENANCE BOOKS.

**EQUIPMENT PROTECTION**

PROPERLY AND COMPLETELY PROTECT AGAINST ALL DAMAGE, ALL APPARATUS, EQUIPMENT, ETC., INCLUDED IN THIS CONTRACT. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR ANY DAMAGE TO FURNISHED APPARATUS, EQUIPMENT, ETC., UNTIL FINAL ACCEPTANCE.

**PROPERTY PROTECTION**

THE CONTRACTOR SHALL TAKE WHATEVER MEANS NECESSARY AND/OR REQUIRED TO PROTECT OWNER'S PROPERTY WITHIN THE WORKING AREAS FROM DUST, DEBRIS AND OTHER MATTER GENERATED BY THE WORK. NO WORK SHALL COMMENCE IN AREAS WHERE PROTECTION IS REQUIRED UNTIL APPROVAL HAS BEEN GIVEN TO THE CONTRACTOR BY THE OWNER.

**MANUFACTURER'S INSTRUCTION**

INSTALL ALL EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS OR REQUIREMENTS FOR PROPER OPERATION AND MAINTENANCE.

**EQUIPMENT PAINTING AND CLEANING**

THOROUGHLY CLEAN ALL ELECTRICAL EQUIPMENT DEVICES AND ENCLOSURES UPON COMPLETION OF ALL WORK. REPAINT ANY EQUIPMENT WHOSE FINISH IS DAMAGED OR RUSTED. MATCH MANUFACTURER'S ORIGINAL FINISH.

**DEMOLITION/REMOVAL AND RECONNECTION**

BEFORE SUBMITTING A BID, THE CONTRACTOR SHALL VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH ALL EXISTING CONDITIONS UNDER WHICH HIS WORK WILL BE INSTALLED.

ALL EXISTING ACTIVE CIRCUITS WHICH FEED EQUIPMENT OR DEVICES THAT ARE TO REMAIN, SHALL BE MAINTAINED IN SERVICE AND SHALL BE PERMANENTLY REFEED.

ALL ITEMS BEING REMOVED SHALL REMAIN THE PROPERTY OF THE CONTRACTOR AND REMOVED FROM THE SITE UNLESS OTHERWISE INDICATED. EQUIPMENT AND DEVICES THE OWNER DOES NOT WISH TO RETAIN SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE.

ALL MATERIAL CHOSEN TO BE RETAINED BY THE OWNER SHALL BE DELIVERED BY THE CONTRACTOR TO SUCH POINT AS DESIGNATED BY THE OWNER.

MATERIAL TO BE REUSED SHALL BE CAREFULLY REMOVED AND STORED AND SHALL BE REINSTALLED IN AS-FOUND CONDITION EXCEPT AS OTHERWISE INDICATED ON THE PLANS. DAMAGE OR LOSS OF MATERIAL TO BE REUSED SHALL BE THE CONTRACTOR'S RESPONSIBILITY AND SHALL BE REPAIRED OR REPLACED WITH THE EQUIVALENT MATERIAL ACCEPTABLE BY THE OWNER.

DISCONNECT AND REMOVE ALL EXISTING ELECTRICAL WORK IN CONTRACT AREA AS INDICATED ON DRAWINGS.

ALL WIRING AND CABLING SHALL BE REMOVED BACK TO ORIGINATION PANEL, UNLESS OTHERWISE INDICATED.

CONTRACTOR SHALL KEEP PREMISES FREE FROM ACCUMULATION OF WASTE MATERIAL AND RUBBISH, AND AT COMPLETION OF WORK DAY, SHALL REMOVE ALL RUBBISH AND IMPLEMENTS TO A DESIGNATED LOCATION, IF AVAILABLE, LEAVING WORK AREAS BROOM CLEAN. UNUSED OUTLET BOXES AND PLASTER RINGS SHALL BE PROVIDED WITH BLANK COVER PLATES AND MATCH DEVICE PLATES WITHIN THE ROOM.

**PENETRATION SEALANT**

ALL PENETRATIONS SHALL BE SEALED WITH 3M INTUMESCENT FIRE BARRIER PENETRATION SEALANT, APPLIED PER MANUFACTURER'S AND U.L. GUIDELINES.

**CUTTING, PATCHING, REPAIRING AND PAINTING**

THE GENERAL CONTRACTOR SHALL PERFORM ALL CUTTING, PATCHING, REPAIRING AND PAINTING FOR ALL ELECTRICAL ITEMS AND EQUIPMENT CALLED FOR UNDER THIS CONTRACT.

**FIRE STOPS AND SEALS**

PENETRATIONS THROUGH FIRE-RATED WALLS, CEILING OR FLOORS IN WHICH CABLES OR CONDUITS PASS SHALL BE FILLED SOLIDLY BY U.L. APPROVED FIRE-STOP MATERIALS, CLASSIFIED FOR AN HOUR RATING EQUAL TO THE FIRE RATING OF THE WALL, CEILING OR FLOOR. PROVIDE TO 3M BRAND FIRE BARRIER CP25WB CAULK OR APPROVED EQUIVALENT.

SEALING BUSHINGS SHALL BE USED ON CONDUIT AND CABLE ENDS TO EFFECTIVELY PREVENT THE INTRUSION OF WATER, A DAMP OR CORROSIVE ATMOSPHERE, DRAFT OR DUST.

THE CONTRACTOR SHALL COORDINATE THE LOCATIONS OF ACCESS PANELS AND DOORS WITH THE GENERAL CONTRACTOR AND OTHER TRADES. FINAL LOCATIONS SHALL BE SUBJECT TO THE APPROVAL OF THE ARCHITECT.

**INTERRUPTION OF EXISTING SERVICES**

PRIOR TO PERFORMING WORK REQUIRING INTERRUPTION OF EXISTING SERVICES, THE CONTRACTOR SHALL SECURE FROM THE OWNER, APPROVAL OF THE PROPOSED OPERATION. (48 HOURS IN ADVANCE) WORK SHALL BE ARRANGED FOR CONTINUOUS PERFORMANCE.

THE CONTRACTOR SHALL PROVIDE ALL NECESSARY LABOR, INCLUDING OVERTIME, OF REQUIRED, TO ASSURE THAT THE EXISTING OPERATING SERVICES WILL BE SHUT DOWN ONLY DURING THE TIME ACTUALLY REQUIRED TO MAKE NECESSARY CONNECTIONS.

**TEMPORARY LIGHT AND POWER**

FURNISH AND INSTALL TEMPORARY ELECTRICAL SERVICE OF SUFFICIENT SIZE FOR POWER AND LIGHTING USE BY ALL TRADE CONTRACTORS DURING THE COURSE OF CONSTRUCTION. ALL TEMPORARY WORK SHALL BE DONE IN COMPLIANCE WITH ALL APPLICABLE ARTICLES IN THE NATIONAL ELECTRICAL CODE, O.S.H.A. AND WITH ALL REQUIREMENTS OF ANY AUTHORITY HAVING JURISDICTION OVER THE WORK. PROVIDE TEMPORARY POWER CONNECTION TO A CONSTRUCTION TRAILER. THE LOCATION OF THE TRAILER IS TO BE DETERMINED ON SITE. PROVIDE FEEDER TO TRAILER OF SUFFICIENT SIZE TO POWER HEATING, AIR CONDITIONING, GENERAL, POWER AND LIGHTING.

**PART 2 – PRODUCTS**

**DESCRIPTION**

ALL MATERIALS AND EQUIPMENT PROVIDED UNDER THIS SECTION SHALL BE NEW, FIRST GRADE, BEST OF THEIR RESPECTIVE KINDS AND IN NO WAY SHALL THEY BE LESS THAN THE QUALITY AND INTENT SET FORTH UNDER THIS SECTION. THEY SHALL MEET THE REQUIREMENTS OF ALL STANDARDS SET UP TO GOVERN THE MANUFACTURER OF ELECTRICAL MATERIALS AND COMPLY WITH ALL APPLICABLE CODES AND STANDARDS.

**WIRE**

CONDUCTORS SHALL BE U.L. LISTED, 600 VOLTS, 90 DEG. C., SINGLE CONDUCTOR TYPE THHN/THHN, 98% CONDUCTIVITY, ANNEALED UNCOATED COPPER WITH PVC INSULATION COVERED WITH NYLON SHEATH JACKET. TESTED IN ACCORDANCE WITH THE REQUIREMENTS OF UNDERWRITERS LABORATORIES STANDARD 83. WIRE SHALL BE IDENTIFIED BY SURFACE MARKING INDICATING MANUFACTURER'S IDENTIFICATION CONDUCTOR SIZE AND METAL. VOLTAGE RATING, U.L. SYMBOL AND TYPE DESIGNATION. CONDUCTORS SHALL BE STRANDED. MINIMUM SIZE SHALL BE #12 AWG UNLESS OTHERWISE INDICATED. MANUFACTURED BY ROME CABLE, TRIANGLE WIRE & CABLE, GENERAL CABLE OR ESSEX WIRE & CABLE.

**ELECTRIC METALLIC TUBING (EMT)**

ELECTRICAL METALLIC TUBING SHALL BE GALVANIZED THIN WALL STEEL CONDUIT, MANUFACTURED BY TRIANGLE WIRE AND CABLE, ALLED TUBE AND CONDUIT, REPUBLIC OR STEELDUOT. THE CONNECTORS AND COUPLINGS SHALL BE HEAVY DUTY, STEEL-ZINC PLATED, SET SCREW TYPE.

**FLEXIBLE METALLIC CONDUIT (FMC)**

FLEXIBLE METALLIC CONDUIT SHALL BE OF HEAVY GALVANIZED SHEET METAL STRIP IN INTERLOCKED CONSTRUCTION, MANUFACTURED BY TRIANGLE WIRE AND CABLE, AMERICAN FLEXIBLE CONDUIT OR ELECTRIC-FLEX. THE CONNECTORS SHALL BE SQUEEZE TYPE MALLEABLE IRON, CADMIUM PLATED.

**FITTINGS**

CONDUIT BODIES FOR RIGID GALVANIZED STEEL CONDUIT (RGS) SHALL BE MALLEABLE IRON-ZINC PLATED WITH TAPERED HUBS AND GASKEED ALUMINUM COVER.

CONDUIT BODIES FOR ELECTRICAL METALLIC TUBING (EMT) SHALL BE CAST ALUMINUM-ALUMINUM ENAMEL FINISH WITH SET SCREW HUBS AND ALUMINUM COVER.

INSULATION BUSHINGS SHALL BE HIGH IMPACT THERMOPLASTIC PHENOLIC WITH 150 DEG. C. UL TEMPERATURE RATING.

INSULATED GROUNDING BUSHINGS SHALL BE MALLEABLE IRON ZINC PLATED WITH MOLDED ON PHENOLIC INSULATION AND LAY-IN GROUNDING LUG.

CONDUIT LOCKNUTS SHALL BE HEAVY NUT STOCK STEEL-ZINC PLATED.

**SUPPORT FITTINGS**

SUPPORT CHANNEL SHALL BE ROLL-FORMED #12 GAUGE STEEL, SOLID BASE OR BOLT HOLE BASE – HOT DIP GALVANIZED FINISH, COMPLETE WITH ANGLE FITTINGS, SPRING NUTS, CONDUIT SUPPORTS, 3/8" OR 1/2" THREADED RODS (SIZE REQUIRED FOR LOAD), ETC.

**CABLE TIES**

CABLE TIES SHALL BE FABRICATED OF ONE-PIECE HALLBAR WITH NO METAL PARTS. MANUFACTURED BY BURNDY, T&B, PANDUIT OR BLACKBURN.

**FUSES**

FUSES SHALL NOT BE INSTALLED UNTIL EQUIPMENT IS READY TO BE ENERGIZED. THIS MEASURE PREVENTS FUSE DAMAGE DURING SHIPMENT OF THE EQUIPMENT FROM THE MANUFACTURER TO THE JOB SITE.

ALL FUSES SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. FUSES SHALL BE OF THE SAME MANUFACTURER, COPPER BUSSMAN, TERRAZ SHAWMUT OR LITTLEFUSE. FUSE TYPES DESCRIBE BELOW SHALL BE U.L. LISTED DUAL ELEMENT TIME DELAY TYPE.

CIRCUIT 0 TO 600 AMPERE SHALL BE PROTECTED BY DUAL ELEMENT, TIME DELAY, CURRENT LIMITING FUSES WITH AN INTERRUPTING RATING OF 200,000 A.I.C. U.L. LISTED CLASS "RK1".

FUSES SHALL HAVE VOLTAGE RATING BASED ON DISTRIBUTION REQUIREMENT SYSTEMS. UPON COMPLETION OF THE WORK, THE CONTRACTOR SHALL PROVIDE THE OWNER WITH THE SPARE FUSES LISTED BELOW.

10% (MINIMUM OF THREE) OF EACH TYPE AND RATING INSTALLED, 0 TO 600 AMPERES.

**MAIN SERVICE ENTRANCE CABINET**

REFER TO ONE-LINE POWER RISER AND NOTES FOR REQUIREMENTS.

THE SERVICE ENTRANCE SHALL HAVE A CONTINUOUS CURRENT RATING OF 400 AMPERES AT 208Y/120, THREE (3) PHASE, FOUR (4) WIRE, 60 CYCLE WITH A SHORT CIRCUIT RATING OF 100,000 AMPERES RMS SYMMETRICAL OR AS INDICATED ON SCHEDULES. U.L. LISTED AND LABELED FOR SERVICE ENTRANCE. WALL MOUNTED TAMPER-PROOF ENCLOSURE WITH ANSI-61 LIGHT GRAY PAINT FINISH, FRONT ACCESSIBLE CABLE TERMINATORS. ALL BUS CONDUCTORS SHALL BE TIN PLATED ALUMINUM, 400A FUSIBLE SWITCH MAN DEVICE. UTILITY CURRENT TRANSFORMER COMPARTMENT INCLUDES FRONT HINGED COVER WITH PROVISION FOR LOCK WIRE SEALING AND BAR TYPE CURRENT TRANSFORMER MOUNTING. PROVIDE FULL SECTION WIRE COMPARTMENT. MANUFACTURED BY GENERAL, ELECTRIC, SIEMENS, SQUARE 'D', CUTLER HAMMER. REFER TO PLANS FOR ADDITIONAL REQUIREMENTS.

**MAIN DISTRIBUTION PANEL (MDP)**

MDP SHALL BE DEAD FRONT TYPE WITH CIRCUIT BREAKERS. PROVIDE WITH FULLY RATED HARD-DRAWN COPPER, 98 PERCENT CONDUCTIVITY PHASE AND GROUND BUS LUGS SIZED TO ACCOMMODATE WIRE QUANTITIES AND SIZES. MDP SHALL BE U.L. LISTED. ENCLOSURE SHALL BE CORROSION RESISTANT ZINC FINISH GALVANIZED. FRONTS TO BE REINFORCED STEEL. POWDER FINISH PAINTED LIGHT GRAY (ANSI-61). PHASE BUS SHALL BE SEQUENCE AND FULLY INSULATED. MANUFACTURED BY GENERAL, ELECTRIC, SIEMENS, SQUARE 'D', CUTLER HAMMER. REFER TO SCHEDULES FOR K&C RATING.

**CIRCUIT BREAKERS**

BRANCH CIRCUIT BREAKERS SHALL BE QUICK-MAKE, QUICK-BREAK, BOLT-IN THERMAL MAGNETIC TYPE WITH VISIBLE CURRENT RATING AND TRIP POSITION. MANUFACTURED BY GENERAL, ELECTRIC, SIEMENS, SQUARE 'D' OR CUTLER HAMMER. REFER TO SCHEDULES FOR K&C RATING.

ALL MULTI-POLE BREAKERS SHALL BE EQUIPPED WITH HANDLE TIES FOR MULTI-POLE USE.

**PHASE SEQUENCE AND BALANCING**

MAINTAIN CORRECT PHASE SEQUENCE OF ALL FEEDERS AND CIRCUITS WITH PHASE IDENTIFICATION THROUGHOUT THE ENTIRE SYSTEM. BALANCING ALL FEEDERS AND CIRCUITS TO WITHIN 10 PERCENT.

**JUNCTION BOXES, PULLBOXES AND WIREWAYS**

JUNCTION BOXES, PULLBOXES AND WIREWAYS SHALL BE OF PROPER TYPE AND SIZES AS REQUIRED. CODE GAUGE GALVANIZED STEEL WITH KNOCKOUTS AND FLANGES TO RECEIVE THE COVERS. COVERS SHALL BE FLAT, OF THE SAME MATERIAL AS THE BOX AND FASTENED TO THE BOX WITH MACHINE SCREWS. MANUFACTURED BY HOFFMAN, SQUARE 'D', OR LEE PRODUCTS.

**BACKBOARDS**

BACKBOARDS SHALL BE FIRE RETARDANT, HICKSON CO. (DRI-CON) 3/4 INCH TYPE AS PL WOOD OF SUFFICIENT SIZE FOR MOUNTING OF SPECIFIED EQUIPMENT. PAINT ALL SIDES WITH TWO (2) COATS OF FIRE-RETARDANT GRAY ENAMEL PAINT.

**GROUND RODS**

GROUND RODS SHALL BE HIGH STRENGTH STEEL CORE WITH ELECTROLYTIC ALLOY BONDED COPPER JACKET. GROUND RODS SHALL CONFORM TO THE REQUIREMENTS OF THE U.L. SPEC. NO. 467 (ANSI C-33.8-1972). MINIMUM SIZE SHALL BE 5/8 INCH DIAMETER BY EIGHT (8) FT. UNLESS OTHERWISE INDICATED. LENGTH MANUFACTURED BY ERICO, BLACKBURN PRODUCTS, ANIKTER, OR GAVIN.

**PART 3 – EXECUTION**

**INSTALLATION**

ALL WORK, MATERIALS AND MANNER OF INSTALLING SAME SHALL BE IN STRICT ACCORDANCE WITH THE LATEST REQUIREMENTS OF THE NATIONAL ELECTRIC CODE.

ALL CONDUIT AND WIRING SHALL BE INSTALLED CONCEALED UNLESS OTHERWISE NOTED. WIRING IN UNFINISHED AREAS SHALL BE INSTALLED EXPOSED USING EMT OR RGS CONDUIT. WIRING IN FINISHED AREAS SHALL BE INSTALLED IN WIREMOLD RACEWAY.

**RACEWAYS**

RACEWAYS, ENCLOSURES AND BOXES SHALL BE MECHANICALLY JOINED TO FORM A CONTINUOUS ELECTRICAL PATH.

THE CONTRACTOR SHALL PROVIDE APPROVED TYPE PULL BOXES AS REQUIRED. MINIMUM SIZE CONDUIT SHALL BE 3/4" UNLESS OTHERWISE NOTED.

FURNISH LOCKNUTS AND BUSHINGS FOR ALL CONDUIT TERMINATIONS IN ALL OUTLET BOXES, PANELS, PULL BOXES, CONDUIT STUBS, ETC.

ELECTRICAL METALLIC TUBING (EMT) SHALL BE USED FOR CONCEALED AND EXPOSED WIRING IN DRY LOCATIONS AS FOLLOWS:

- 1. INTERIOR PANEL FEEDERS
- 2. INTERIOR LIGHTING, RECEPTACLE AND POWER BRANCH CIRCUIT WIRING

ALL CONDUIT SHALL BE INSTALLED IN PARALLEL AND PERPENDICULAR TO THE BUILDING LINES.

ALL CONDUIT SHALL BE SUPPORTED USING CADMIUM PLATED CONDUIT STRAPS AND HANGERS.

SEPARATE CONDUIT SYSTEMS SHALL BE INSTALLED FOR NORMAL AND EMERGENCY POWER.

**WIRING**  
THE TERM "WIRING" SHALL BE CONSIDERED TO BE COMPRISED OF THE CONDUIT, CONDUCTORS, CONNECTIONS, ETC.

**SPLICING**

SPLICING SHALL BE DONE WITH INSULATED OR NON-INSULATED CONNECTORS OF APPROPRIATE TYPES AND CURRENT-CARRYING CAPACITY. NON-INSULATED CONNECTORS SHALL BE WRAPPED WITH INSULATING TAPE TO THE THICKNESS OF THE INSULATION OF THE CONDUCTORS BEING SPICED. ELECTRICAL TAPE SHALL BE 3M OR SUPER 88 SCOTCH VINYL FLAME-RETARDANT , COLD AND WEATHER RESISTANT.

SPLICERS FOR CONDUCTORS, SIZES #10 AWG OR SMALLER SHALL BE MADE WITH U.L. LISTED SPRING-TYPE CONNECTORS OR APPROPRIATE CURRENT CARRYING CAPACITY.

SPLICES, TAPS AND TERMINALS FOR CONDUCTORS #8 AWG OR LARGER SHALL BE MADE WITH U.L. LISTED BOLTED PRESSURE CONNECTORS OF BRONZE OR COPPER CONSTRUCTION, OF APPROPRIATE CURRENT CARRYING CAPACITY. EQUAL TO O/Z GEDNEY, BURNDY OR BLACKBURN.

**CONDUCTOR IDENTIFICATION**

CONDUCTORS #8 AWG AND SMALLER SHALL HAVE A COLOR-CODED INSULATION.

CONDUCTORS #6 AWG AND LARGER SHALL BE IDENTIFIED WITH TAPES APPLIED NEAR THE ENDS OF THE CONDUCTORS.

FEEDERS AND BRANCH CIRCUIT CONDUCTORS SHALL BE IDENTIFIED FOR PHASE ROTATION.

208/120V/3PH

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

ALL FEEDERS, MAINS AND BRANCH CIRCUIT CONDUCTORS SHALL BE TAGGED AT BOTH ENDS WITH WIRE MARKERS IN ALL PANELS, MOTOR CONTROLS, JUNCTION BOXES, OUTLET BOXES AND DEVICE BOXES.

**IDENTIFICATION**

FURNISH AND INSTALL NAMEPLATES FOR ALL ELECTRICAL EQUIPMENT, IDENTIFYING ITEMS BY NAME, FUNCTION AND/OR CONTROL.

IDENTIFYING NAMEPLATES SHALL BE LAMINATED, PLASTIC TYPE, CONSISTING OF TWO BLACK PLASTIC SHEETS WITH ONE WHITE PLASTIC SHEET BONDED TO AND BETWEEN THE TWO OUTER BLACK SHEETS AND HAVING THE LETTERS ENGRAVED IN ONE BLACK TO THE DEPTH OF THE WHITE PLASTIC. FASTEN NAMEPLATES TO EQUIPMENT WITH SUITABLE ADHESIVES OR STAINLESS STEEL SCREWS.

ALL PANELS SHALL HAVE TYPEWRITTEN CIRCUIT DIRECTORIES IDENTIFYING ALL BRANCH CIRCUITS. PROVIDE ADDITIONAL COPY OF COMPLETE UPDATED PANEL DIRECTORY TO FACILITY ENGINEERING.

USE PLASTIC-COATED WIRE MARKERS OF THE SELF-ADHESIVE, WRAPAROUND TYPE WITH PERMANENT FACTORY-PRINTED NUMBER, LETTERS AND SYMBOLS.

WIRE MARKERS SHALL BE SECURELY ATTACHED AT BOTH ENDS, IDENTIFYING PANEL AND CIRCUIT BREAKER NUMBERS.

ALL CONDUCTORS SHALL BE PERMANENTLY TAGGED AT TIME OF INSTALLATION. LABELS SHALL BE EQUAL TO T&B, PANDUIT OR IDEAL.

**GROUNDING**

ALL ELECTRICAL WORK SHALL BE GROUNDED AND BONDED IN FULL CONFORMANCE WITH THE LATEST APPROVED EDITION OF THE NATIONAL ELECTRICAL CODE AND LOCAL REQUIREMENTS.

ALL ELECTRICAL EQUIPMENT, PANEL BOARD ENCLOSURES, SAFETY SWITCHES, METAL ENCLOSURES, ELECTRICAL DEVICE CLOSURES AND ALL OTHER EQUIPMENT SHALL BE MADE TO FORM A CONTINUOUS CONDUCTING, GROUND PATH OF LOW IMPEDANCE FOR GROUND FAULT CIRCUITS AND OPERATION OF THE CIRCUIT PROTECTIVE DEVICES WITHIN EACH CIRCUIT.

PROVIDE GROUNDING CONDUCTOR IN ALL RACEWAYS.

GROUND CONNECTIONS WITH THE GROUNDING CONDUCTORS SHALL BE MADE AT EACH OUTLET BOX, LIGHTING FIXTURE, MOTOR AND OTHER EQUIPMENT COMPONENTS BY MEANS OF A POSITIVELY COVERED GROUNDING CLAMP, SCREW OR CLIP. CONNECTIONS TO GROUNDING RODS, OTHER GROUNDING ELECTRODE CONDUCTORS SHALL BE MADE WITH CADWELL TYPE, EXOTHERMIC WELD PROCESS UNLESS OTHERWISE NOTED. CONNECTIONS TO PIPES SHALL BE MADE WITH APPROVED BRONZE OR BRASS CLAMPS.

BONDING SHALL BE PROVIDED TO ASSURE ELECTRICAL CONTINUITY AND THE CAPACITY TO SAFELY CONDUCT ANY FAULT CURRENT LIKELY TO BE IMPOSED.

**SEISMIC RESTRAINT**

SEISMIC LATERAL RESTRAINTS DESIGNED TO RESIST HORIZONTAL MOVEMENT IN ANY DIRECTIONS SHALL BE INSTALLED IN ALL SUSPENDED CONDUITS 2-1/2 INCHES IN DIAMETER OR GREATER. QUANTITY AND LOCATION OF THE LATERAL RESTRAINTS SHALL BE BASED ON THE CONDUIT SYSTEM LAYOUT AND IN GENERAL, SHALL BE INSTALLED AT CONDUIT BENDS, JUNCTION BOXES AND APPROXIMATELY EVERY 20 FEET ALONG CONDUIT RUNS. SEISMIC LATERAL RESTRAINTS ARE NOT REQUIRED FOR ANY PIPING SUSPENDED BY INDIVIDUAL HANGERS 12 INCHES OR LESS IN