# ELECTRICAL SPECIFICATIONS

## SCOPE

A. INCLUDES THE FURNISHING OF ALL LABOR, SUPERVISION, MATERIALS, EQUIPMENT, TOOLS, ETC., REQUIRED FOR THE ELECTRICAL SYSTEMS AS SHOWN AND DESCRIBED IN THESE DRAWINGS.

B. THE WORK SHALL INCLUDE, BUT IS NOT NECESSARILY LIMITED TO, THE FOLLOWING:

1. RACEWAYS
2. BUILDING WIRE AND CABLE
3. ELECTRICAL BOXES AND FITTINGS
4. SUPPORTING DEVICES
5. SEISMIC RESTRAINTS
6. ELECTRICAL IDENTIFICATION
7. GROUNDING
8. LIGHTING

## WORK BY OTHERS

A. THE FOLLOWING WORK RELATED TO WORK UNDER THIS DIVISION OF THE SPECIFICATIONS WILL BE PROVIDED BY OTHERS:

1. HEATING VENTILATING, AIR CONDITIONING AND PLUMBING EQUIPMENT, INCLUDING MOTORS, MOTOR STARTERS AND CONTROL EQUIPMENT WILL BE FURNISHED AND INSTALLED UNDER DIVISION 15.
2. PAINTING, EXCEPT REPAIR OF FACTORY APPLIED FINISHES ON ELECTRICAL EQUIPMENT.
3. TELECOM SYSTEMS PREMISES WIRING AND ASSOCIATED SERVICE EQUIPMENT EXCLUDING EQUIPMENT REQUIRED BY LOCAL SERVICE PROVIDER(S) FOR SERVICE ENTRANCE INTO FACILITY.

## CODES AND PERMITS

A. ALL WORK UNDER DIVISION 16 SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE 2008 EDITION OF THE NATIONAL ELECTRICAL CODE, AND THE LATEST EDITION OF ALL LOCAL OR STATE CODES, LAWS, AND ORDINANCES, AND THE REQUIREMENTS OF THE LOCAL ELECTRIC UTILITY.

B. THIS CONTRACTOR SHALL APPLY FOR, OBTAIN, AND PAY FOR ALL PERMITS REQUIRED. AT THE CONCLUSION OF THE INSTALLATION, HE OR SHE SHALL SECURE A CERTIFICATE OF INSPECTION, PROPERLY SIGNED BY THE CONTROLLING BUILDING DEPARTMENT, WHICH SHALL STATE THAT ALL RULES HAVE BEEN COMPLIED WITH AND THAT THE WORK IS SATISFACTORY.

C. SHOULD ANY PART OF THE PLANS OR SPECIFICATIONS BE FOUND TO BE IN CONFLICT WITH APPLICABLE CODES OR ORDINANCES, THE CONTRACTOR SHALL NOTIFY THE ENGINEER BEFORE SUBMITTING HIS OR HER BID.

## TRADE NAMES AND EQUALS

A. MANUFACTURER'S TRADE NAMES OR CATALOG NUMBERS USED IN THESE SPECIFICATIONS AND INDICATED ON THE DRAWINGS DENOTE TYPE, SIZE, QUALITY, AND DESIGN OF EQUIPMENT REQUIRED.

B. WHERE EQUIPMENT IS SPECIFIED AS "EQUAL", OR "APPROVED EQUAL", IT SHALL MEAN EQUAL IN THE OPINION OF THE ENGINEER. THIS CONTRACTOR IS FREE TO OFFER SUBSTITUTIONS FOR CONSIDERATION AS EQUAL AFTER THE CONTRACT IS SIGNED; HOWEVER, HE SHALL BE PREPARED TO FURNISH SPECIFIED MATERIALS WHERE SUBSTITUTIONS ARE NOT APPROVED.

## MATERIAL AND EQUIPMENT

A. ALL MATERIALS AND EQUIPMENT SHALL BE NEW AND OF THE QUALITY SPECIFIED.

B. MATERIAL OR EQUIPMENT THAT HAS BEEN STORED OUTDOORS UNPROTECTED FOR LONG PERIODS OF TIME OR OTHERWISE DAMAGED IS NOT ACCEPTABLE AS NEW MATERIAL.

C. APPARATUS AND MATERIALS USED IN THIS WORK WHICH ARE SUBJECT TO APPROVAL OF UNDERWRITERS LABORATORIES (UL) SHALL BEAR THE UL LABEL, OR BE UNDERWRITERS LISTED.

## DELIVERY, STORAGE, AND HANDLING OF MATERIAL AND EQUIPMENT

A. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PURCHASE, DELIVERY, AND STORAGE OF ALL MATERIALS AND EQUIPMENT INDICATED TO BE SUPPLIED UNDER THIS SECTION OF THE SPECIFICATIONS, AND IT SHALL BE HIS OR HER RESPONSIBILITY TO SCHEDULE THE DELIVERY OF MATERIALS AND EQUIPMENT AT SUCH STAGES OF THE WORK AS WILL PERMIT UNINTERRUPTED CONSTRUCTION OF ALL PHASES OF THE WORK.

B. WHERE OWNER FURNISHED EQUIPMENT IS TO BE TURNED OVER TO THIS CONTRACTOR FOR INSTALLATION, IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO RECEIVE SUCH EQUIPMENT AND STORE IN A SAFE, DRY LOCATION.

C. THIS CONTRACTOR SHALL DO ALL REQUIRED RIGGING, HOISTING, TRANSPORTING, ETC., OF ALL EQUIPMENT FURNISHED UNDER THIS CONTRACT, AND SHALL FURTHER FURNISH ANY ADDITIONAL STRUCTURAL MEMBERS, AS MAY BE REQUIRED, FOR THE PROPER SUPPORT OF ANY AND ALL EQUIPMENT FURNISHED HEREUNDER.

## ACCURACY OF DATA

A. THE DRAWINGS ARE GENERALLY DIAGRAMMATIC, AND EXCEPT WHERE DIMENSIONS ARE SHOWN, ARE NOT INTENDED TO SHOW THE EXACT LOCATIONS OF OUTLETS, CONDUITS, SWITCHES, FIXTURES, ETC. ALL WORK SHALL BE INSTALLED AS NEARLY AS POSSIBLE IN THE LOCATIONS INDICATED, WITH ONLY SUCH MINOR ADJUSTMENTS AS WILL BE REQUIRED TO AVOID INTERFERENCES WITH STRUCTURE OR THE WORK OF OTHER TRADES.

B. SHOULD ANY STRUCTURAL OR MECHANICAL INTERFERENCES PREVENT THE INSTALLATION OF CONDUIT, SETTING OF JUNCTION BOXES AND CABINETS, ARRANGEMENT OF LIGHTING FIXTURES AND METHOD OF SUSPENSION, ETC., IN THE LOCATIONS INDICATED ON THE DRAWINGS, THE NECESSARY DEVIATIONS THEREFROM MUST BE MADE WITHOUT ADDITIONAL COST TO THE OWNER, WHERE RELOCATION IS NOT OVER FIVE (5) FEET FROM THE LOCATION SHOWN ON THE DRAWINGS.

C. THE DRAWINGS ARE FURTHER NOT INTENDED TO SHOW ALL JUNCTION OR PULL BOXES, FITTINGS AND CONNECTIONS, AND DETAILS OF WORK TO BE DONE. THIS CONTRACTOR SHALL SUPPLY ALL NECESSARY BOXES, FITTINGS, AND CONNECTIONS FOR COMPLETE INSTALLATION IN A SATISFACTORY MANNER.

D. ANY OFFSETS IN CONDUIT REQUIRED OR NECESSARY TO AVOID INTERFERENCES WITH STRUCTURE, OR THE WORK OF OTHER TRADES, ETC., SHALL BE MADE AT NO ADDITIONAL COST TO THE OWNER.

E. REFER TO ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR ALL DIMENSIONS OF BUILDING SPACES.

F. THIS CONTRACTOR SHALL PREPARE SHOP DRAWINGS, AS NECESSARY, FOR HIS OR HER USE IN COORDINATING THE WORK TO AVOID INTERFERENCE.

G. THE DRAWINGS AND SPECIFICATIONS ARE COMPLEMENTARY TO EACH OTHER, AND WHAT IS CALLED FOR BY ONE SHALL BE AS BINDING AS IF CALLED FOR BY BOTH.

## COORDINATION

A. THE ELECTRICAL CONTRACTOR SHALL COORDINATE HIS OR HER WORK WITH THAT OF OTHER SUBCONTRACTORS ON THE JOB AND ALSO WITH THAT OF THE OWNER IN ORDER THAT THERE BE NO DELAY IN THE PROPER INSTALLATION AND COMPLETION OF THE SEVERAL PARTS OF THE WORK.

B. THIS CONTRACTOR SHALL USE EVERY PRECAUTION TO PROTECT THE WORK OF OTHERS, AND HE WILL BE HELD RESPONSIBLE FOR ALL DAMAGE DONE BY HIS OR HER WORKERS TO THE WORK OF OTHER TRADES. HE OR SHE SHALL ALSO PROTECT HIS OR HER WORK FROM DANGER OF BREAKAGE, DIRT, FOREIGN MATERIALS, ETC., AND SHALL REPLACE ALL WORK SO DAMAGED.

C. COORDINATE PHASES OF THE WORK WITH THE OWNER AND OTHER TRADES TO ALLOW THE OWNER TO CONTINUE NORMAL BUSINESS OPERATIONS THROUGHOUT THE DURATION OF THE PROJECT. ANY NECESSARY POWER OUTAGES SHALL BE SCHEDULED FOR OTHER THAN THE OWNER'S HOURS OF OPERATION, OR BE PRE-ARRANGED WITH THE OWNER.

## MANUFACTURER'S RECOMMENDATIONS

A. UNLESS SPECIFICALLY INDICATED OTHERWISE, ALL EQUIPMENT AND MATERIALS SHALL BE INSTALLED IN ACCORDANCE WITH THE BEST RECOMMENDATION OF THE MANUFACTURER. A COPY OF THE MANUFACTURER'S INSTALLATION RECOMMENDATIONS SHALL BE KEPT IN THE JOB SUPERINTENDENT'S OFFICE AND SHALL BE AVAILABLE TO THE OWNER'S REPRESENTATIVE AT ALL TIMES.

## CUTTING AND PATCHING

A. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING REQUIRED FOR THE INSTALLATION OF HIS WORK, AND HE SHALL EMPLOY WORKERS SKILLED IN THE TRADES REQUIRED FOR ALL CUTTING AND PATCHING WORK.

B. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER LOCATION OF ALL CHASES, RECESSES, AND OPENINGS REQUIRED FOR HIS WORK.

C. THIS CONTRACTOR SHALL PROVIDE ALL SLEEVES, ETC., REQUIRED FOR THE INTRODUCTION AND PLACEMENT OF HIS WORK, AND SHALL BE RESPONSIBLE FOR THE CORRECT LOCATION OF SAME.

D. BEAMS OR COLUMNS SHALL NOT BE PIERCED WITHOUT PERMISSION OF THE STRUCTURAL ENGINEER, AND THEN ONLY AS DIRECTED.

## PROTECTION OF FLOORS

A. THIS CONTRACTOR'S ATTENTION IS DIRECTED TO THE NEED TO PROTECT FINISHED FLOORS, AND HE OR SHE WILL BE HELD RESPONSIBLE FOR DAMAGE HE OR SHE MAY DO TO FINISHED FLOORS. WHERE HEAVY EQUIPMENT IS TO BE MOVED ACROSS FINISHED FLOORS, THIS CONTRACTOR SHALL MAKE PROVISIONS TO PROTECT THE FLOOR.

B. WHERE PIPE CUTTINGS AND THREADING OPERATIONS ARE CARRIED ON BY THIS CONTRACTOR, HE OR SHE SHALL PROVIDE A SUITABLE COVERING MATERIAL OVER THE FLOOR WHICH WILL ASSURE THAT OIL AND PIPE CUTTINGS DO NOT COME IN CONTACT WITH THE FINISHED FLOOR. TEMPORARY FLOOR COVERING SHALL BE PLYWOOD OR OTHER MATERIALS AS MAY BE APPROVED BY THE ENGINEER.

C. THIS CONTRACTOR SHALL REMOVE ALL TEMPORARY FLOOR COVERING, AS HE OR SHE COMPLETES HIS OR HER WORK IN EACH AREA. ANY DAMAGE RESULTING FROM ACTIVITIES OF THIS CONTRACTOR SHALL BE REPAIRED AT HIS OR HER OWN EXPENSE.

## PAINTING

A. THE ELECTRICAL CONTRACTOR SHALL REFINISH AND RESTORE TO THE ORIGINAL CONDITION AND APPEARANCE, ALL ELECTRICAL EQUIPMENT WHICH HAS SUSTAINED DAMAGE TO MANUFACTURER'S FINISH PAINT. FINISHES SHALL INCLUDE GALVANIZING THAT HAS BEEN REMOVED DURING INSTALLATION.

B. ALL ELECTRICAL EQUIPMENT SHALL BE PROVIDED WITH FACTORY APPLIED PRIME AND FINISH PAINT, UNLESS OTHERWISE SPECIFIED.

## SHOP DRAWINGS (SUBMITTALS)

A. SIX COPIES OF SHOP DRAWINGS AND/OR MANUFACTURER'S DESCRIPTIVE DATA OF A NATURE TO COMPLETELY IDENTIFY THE EQUALITY OF THE MATERIAL OR EQUIPMENT INTENDED FOR INSTALLATION SHALL BE SUBMITTED FOR APPROVAL BEFORE BEGINNING ANY CONSTRUCTION AND WITHIN THIRTY DAYS AFTER SIGNING CONTRACT. FAILURE TO SUBMIT DATA FOR APPROVAL WITHIN THIRTY DAYS TIME LIMIT WILL BE CONSTRUED AS MEANING EQUIPMENT CALLED FOR BY NAME WILL BE FURNISHED. DATA SHALL BE ORGANIZED IN SAME ORDER AS LISTED BELOW, SHALL BE SUBMITTED ALL IN ONE THREE RING BINDER, INDEXED BY FLYSHEET ON FRONT PAGE, EACH ITEM TABBED AND LABELED, ARRANGED IN THE ORDER THEY APPEAR IN THE SPECIFICATIONS, AND BE BOUND IN SETS, ALL SETS IDENTICAL. NO EXCEPTION WILL BE MADE TO THIS PROCEDURE AND TIME SCHEDULE.

B. EACH ITEM SUBMITTED FOR REVIEW SHALL HAVE SUBMITTAL DATA PRECEDED BY A TYPEWRITTEN DESCRIPTION (BY CONTRACTOR OR ITEM SUPPLIER) OF THE ITEM. DESCRIPTION TO INCLUDE MAKE AND MODEL NUMBERS AND SHALL DESCRIBE THE ITEM. LIST ALL OPTIONS AND ACCESSORIES SHOWN ON SHOP DRAWINGS WHICH ARE NOT INCLUDED.

SUBMIT THE FOLLOWING FOR APPROVAL:

1. RACEWAYS
2. WIRES AND CABLES
3. ELECTRICAL BOXES
4. WIRE CONNECTION AND CONNECTING DEVICES
5. WIRING DEVICES
6. CONTACTORS AND LIGHTING CONTROL EQUIPMENT
7. LAMPS, DRIVERS, AND LIGHTING FIXTURES

C. CONTRACTOR SHALL SUBMIT 1/4" SCALED PLANS OF EACH ELECTRICAL ROOM DEPICTING THE LOCATION AND ARRANGEMENT OF ALL ELECTRICAL EQUIPMENT.

## RECORD DRAWINGS

A. THIS CONTRACTOR SHALL MAINTAIN A COMPLETE UP-TO-DATE SET OF RECORD DRAWINGS AND SPECIFICATIONS ON THE JOB SITE. DRAWINGS SHALL BE MAINTAINED IN A NEAT CONDITION AND SHALL CLEARLY SHOW ANY CHANGES FROM ORIGINAL DRAWINGS AND SPECIFICATIONS.

B. CONTRACTOR SHALL USE A DESIGNATED SET OF PRINTS OF THE CONTRACT DOCUMENTS, AS PREPARED BY THE ENGINEER, TO MARK UP FOR RECORD DRAWING PURPOSES.

C. THE CONTRACTOR SHALL PREPARE A SET OF REPRODUCIBLE RECORD DRAWINGS. THESE DRAWINGS AND A SET OF SPECIFICATIONS SHALL BE TURNED OVER TO THE OWNER AND SHALL BECOME THE PROPERTY OF THE OWNER BEFORE FINAL PAYMENT WILL BE MADE.

## MAINTENANCE MANUALS

A. CONTRACTOR SHALL PROVIDE THREE (3) COPIES OF OPERATIONAL AND MAINTENANCE MANUALS FOR ALL EQUIPMENT INSTALLED UNDER THIS DIVISION OF THE SPECIFICATIONS. THE MANUALS SHALL INCLUDE A LIST OF SPARE PARTS AND PROPER OPERATIONAL AND MAINTENANCE PROCEDURES.

B. THE MANUALS SHALL BE ORGANIZED AND FULLY INDEXED. MANUALS SHALL CONSIST OF THREE-RING, HARD BACK BINDERS WITH APPROPRIATE DIVIDERS FOR EACH PART.

C. MANUAL CONTENTS SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO THE FOLLOWING:

1. NAME AND ADDRESS OF CONTRACTOR, EQUIPMENT MANUFACTURER AND SUPPLIER
2. SET OF APPROVED SHOP DRAWINGS OR APPROVED SUBMITTAL DATA
3. WIRING DIAGRAMS AND INSTALLATION DRAWINGS
4. SPARE PARTS AND REPLACEMENT PARTS LISTS AS RECOMMENDED BY THE MANUFACTURER
5. PROPER OPERATIONAL PROCEDURES AND MAINTENANCE PROCEDURES
6. INSTALLATION AND OPERATIONAL MANUALS
7. MAINTENANCE AND SERVICE MANUALS
8. COPY OF WARRANTIES AND GUARANTEES

D. OPERATING AND MAINTENANCE MANUALS SHALL BE TURNED OVER TO THE OWNER BEFORE FINAL PAYMENT WILL BE MADE.

E. IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO MAINTAIN, WARRANT, CLEAN, ETC., ANY EQUIPMENT SUPPLIED BY THIS CONTRACTOR UNTIL ALL INSTALLATION AND OPERATING AND MAINTENANCE MANUALS ARE TURNED OVER TO THE OWNER.

## TEMPORARY CONSTRUCTION POWER AND LIGHTING

A. THIS CONTRACTOR SHALL FURNISH AND INSTALL ALL TEMPORARY WIRING FOR CONSTRUCTION POWER AND LIGHTING FOR THE PROJECT AS REQUIRED.

## TESTS

A. THE ENTIRE BUILDING WIRING SYSTEM SHALL BE THOROUGHLY TESTED AND CORRECTED OF ALL DEFECTS. ALL ELECTRICAL WIRING SHALL BE TESTED FOR CONTINUITY, SHORTS, IMPROPER GROUNDS AND INSULATION RESISTANCE. MOTORS SHALL BE CHECKED FOR PROPER ROTATION AND BRANCH CIRCUIT AND OVERLOAD PROTECTION. PANELBOARDS SHALL BE CHECKED FOR BALANCED LOADING AND CORRECT PHASE ROTATION. ALL DISCREPANCIES SHALL BE CORRECTED. THIS CONTRACTOR SHALL FURNISH TEST EQUIPMENT AND MATERIAL, AND SHALL BE RESPONSIBLE FOR REPLACEMENT OR REPAIR OF DAMAGE DUE TO TEST FAILURES.

C. AFTER ALL TESTS HAVE BEEN COMPLETED, THIS CONTRACTOR SHALL CLEAN ALL THE FIXTURES AND REPLACE ANY LAMPS USED FOR TEMPORARY LIGHTING. ALL EQUIPMENT AND CONDUIT SHALL BE CLEANED AND LEFT IN WORKING ORDER. ALL DEBRIS CREATED BY THE EXECUTION OF THE ELECTRICAL WORK SHALL BE REMOVED BY THIS CONTRACTOR. THIS CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO KEEP PANELS, ESPECIALLY CIRCUIT BREAKER HANDLES, CLEAN DURING CONSTRUCTION.

D. CHECK ALL CONTROL AND INTERLOCKING WIRING FOR PROPER OPERATIONS. PERFORM OPERATIONAL TESTS TO ASSURE THAT CONTROL WIRING HAS BEEN PROPERLY INSTALLED.

E. PRIOR TO FINAL ACCEPTANCE, CONTRACTOR SHALL PROVIDE ALL TEST RESULTS TO ENSURE THAT SYSTEM IS FREE OF DEFECTS AND FULLY OPERATIONAL.

## GUARANTEE

A. THE CONTRACTOR SHALL GUARANTEE TO THE OWNER ALL WORK PERFORMED UNDER THIS CONTRACT TO BE FREE FROM DEFECTS IN WORKMANSHIP AND MATERIAL FOR A PERIOD OF ONE (1) YEAR FROM DATE OF FINAL ACCEPTANCE. DEFECTS ARISING DURING THIS PERIOD WILL BE PROMPTLY REMEDIED BY THE CONTRACTOR AT HIS OR HER OWN EXPENSE UPON NOTICE BY THE OWNER. ALL LAMPS FOR LIGHTING FIXTURES SHALL BE EXCLUDED FROM THIS GUARANTEE, BUT ONE (1) COMPLETE AND OPERATIVE SET OF LAMPS FOR LIGHTING FIXTURES SHALL BE IN PLACE AT THE TIME OF FINAL ACCEPTANCE.

## SITE WORK

A. BEFORE STARTING EXCAVATION, ESTABLISH THE LOCATION OF UNDERGROUND AND OVERHEAD UTILITIES IN THE WORK AREA. EXERCISE CARE TO PROTECT EXISTING UTILITIES DURING EARTHWORK OPERATIONS. PERFORM EXCAVATION WORK NEAR UTILITIES BY HAND AND PROVIDE NECESSARY SHORING, SHEETING, AND SUPPORTS AS THE WORK PROGRESSES.

B. MAINTAIN, PROTECT, RELOCATE, OR EXTEND AS REQUIRED EXISTING UTILITY LINES TO REMAIN WHICH PASS THROUGH THE WORK AREA.

C. IN COORDINATION WITH LOCAL ORDINANCES, REMOVE ABANDONED UTILITY SERVICE LINES FROM AREAS OF EXCAVATION. IF DISCOVERED CAP, PLUG, OR SEAL ABANDONED LINES AND IDENTIFY TERMINATION POINTS AT GRADE LEVEL WITH MARKERS.

D. BACKFILL TRENCHES ONLY AFTER CONDUITS HAVE BEEN INSPECTED AND THE LOCATIONS OF CONDUITS HAVE BEEN RECORDED ON AS-BUILT DRAWINGS.

E. AFTER CONDUIT HAS BEEN LAID AND JOINTED, THE CONDUIT SHALL BE BEDDED IN THE TRENCH AND MADE SECURE AGAINST MOVEMENT BY BACKFILLING THE TRENCH BY HAND WITH 3/4" WASHED GRAVEL OR SAND TO A DEPTH OF 12" ABOVE THE TOP OF THE CONDUIT. ALL SCHEDULE 40 PVC CONDUIT SHALL BE ENCASED IN A 3" CONCRETE ENVELOPE.

F. BACKFILL REMAINING DEPTH WITH EXCAVATED MATERIAL, EXCEPT THAT THE MATERIAL MAY CONTAIN STONES, ROCKS, CONCRETE, OR MASONRY MATERIALS (BUT NO CINDERS), WITH A MAXIMUM DIMENSION OF FOUR (4) INCHES PROVIDED THAT THE VOIDS IN SUCH COARSE MATERIALS ARE COMPLETELY FILLED WITH EARTH OR GRANULAR MATERIAL.

G. THOROUGHLY COMPACT BACKFILL BY TAMPING WITH A MANUAL TAMP OR AN APPROVED MECHANICAL TAMPING DEVICE.

H. WHERE PLACEMENT OF UNDERGROUND CONDUIT DISTURBS PAVED AREAS, THE PAVEMENT SHALL BE REPAIRED WITH MATERIALS OF THE SAME TYPE AND STRENGTH AS THAT REMOVED.

## RACEWAYS

A. ALL WIRING SHALL BE INSTALLED IN A CONTINUOUS RACEWAY SYSTEM, OR TYPE MC CABLE AS ALLOWED ELSEWHERE IN THESE SPECIFICATIONS. CONDUIT SHALL BE RUN CONCEALED OR EXPOSED, AS SPECIFICALLY INDICATED ON THE PLANS. IN GENERAL, CONDUIT IS INDICATED TO BE RUN CONCEALED IN FINISHED AREAS; ALL OTHER CONDUIT IS RUN EXPOSED. DON NOT USE IN CANOPY.

B. ELECTRICAL METALLIC TUBING (EMT) MAY BE USED WHERE CONDUIT IS RUN CONCEALED IN WALLS ABOVE THE FLOOR SLAB AND ABOVE OFFICE SPACES. GRS SHALL BE USED WHERE CONDUITS ARE RUN EXPOSED INSIDE THE BUILDINGS UP TO 6' AFF. EXPOSED CONDUIT ABOVE 6' AFF SHALL BE EMT (UNLESS OTHERWISE NOTED).

C. GALVANIZED RIGID STEEL CONDUIT OR SCHEDULE 40 PVC CONDUIT SHALL BE USED UNDERGROUND AND WHERE CONDUIT IS RUN UNDER THE FLOOR SLAB. GALVANIZED RIGID STEEL ELBOWS SHALL BE USED IN ALL PVC CONDUIT RUNS AND WHERE CONDUITS ARE STUBBED UP THROUGH FLOOR SLABS. GALVANIZED RIGID STEEL CONDUIT, OR INTERMEDIATE METAL CONDUIT SHALL BE USED WHERE CONDUIT PROJECTS ABOVE THE ROOF, WHERE CONDUIT IS SUBJECT TO PHYSICAL DAMAGE, AND ALL OTHER LOCATIONS SPECIFICALLY DESIGNATED ON THE DRAWINGS OR REQUIRED BY THE SPECIFICATIONS.

D. INTERMEDIATE STEEL CONDUIT MAY BE USED IN LIEU OF GALVANIZED RIGID STEEL CONDUIT, WHERE PERMITTED BY CODE.

E. EXPOSED CONDUIT SHALL BE RUN IN PARALLEL ROWS NEATLY RACKED PARALLEL OR PERPENDICULAR TO WALLS AND STRUCTURAL MEMBERS.

F. INSTALL CONDUIT ONLY AFTER PROPOSED RUNS HAVE BEEN CHECKED ON PLANS AND AT SITE FOR INTERFERENCE WITH OTHER TRADES. WHEREVER POSSIBLE, LOCATE CONDUIT OVER PIPING OF OTHER TRADES. ALL HORIZONTAL CONDUIT RUNS IN ATTIC SHALL BE RUN AS HIGH AS POSSIBLE IN ORDER TO PROVIDE FREE SPACE ABOVE CEILING FOR INSTALLATION OF AIR DISTRIBUTION DUCT AND PIPING.

G. ROUGHING-IN DIMENSIONS OF ELECTRICALLY OPERATED EQUIPMENT WILL BE BY TRADES SUPPLYING SAME. SET CONDUIT AND BOXES FOR CONNECTING TO EQUIPMENT ONLY AFTER RECEIVING APPROVED DIMENSIONS AND AFTER CHECKING LOCATIONS WITH OTHER CONTRACTORS.

H. PLUG THE ENDS OF EACH RACEWAY WITH AN APPROVED CAP, OR CAPPED BUSHING TO PREVENT THE ENTRANCES OF FOREIGN MATERIAL DURING THE CONSTRUCTION PERIOD. CONDUIT LEFT EMPTY FOR FUTURE WIRING SHALL BE CAPPED.

I. ARRANGEMENTS OF CONDUIT WIRING AND EQUIPMENT THAT DIFFER MATERIALLY FROM THE OBVIOUS INTENT OF THE PLANS WILL NOT BE PERMITTED, EXCEPT WHERE NECESSARY TO AVOID INTERFERENCES AND ONLY WHERE SPECIFICALLY APPROVED BY THE ENGINEER.

J. CONDUIT SHALL BE SIZED AS INDICATED ON THE PLANS AND WHERE NOT INDICATED, SIZES SHALL MEET NEC REQUIREMENTS FOR NUMBER OF CONDUCTORS TO BE ACCOMMODATED, BASED ON TYPE THHN INSULATED CONDUCTORS.

K. CONDUITS PROJECTING THROUGH ROOFING SHALL BE MADE WATERTIGHT BY PROPER FLASHING AND PITCH POCKETS WITH STORM COLLAR SECURELY FASTENED TO CONDUIT ABOVE THE FLASHING.

L. SHORT LENGTHS OF FLEXIBLE STEEL CONDUIT, "GREENFIELD", MAY BE USED ABOVE FURRED CEILINGS BETWEEN OUTLET BOXES AND LAY-IN TYPE CEILING FIXTURES.

M. ELECTRICAL METALLIC TUBING 3/4" AND LARGER SHALL BE PROVIDED WITH INSULATED CONNECTORS OR END BUSHINGS.

N. MINIMUM SIZE BRANCH CIRCUIT CONDUIT SHALL BE 1/2" NOMINAL SIZE.

O. ALL RIGID AND IMC CONDUIT COUPLINGS, FITTINGS AND CONNECTORS SHALL BE THREADED TYPE.

P. WHERE THE CONTRACTOR ELECTS TO USE EITHER RIGID STEEL CONDUIT OR IMC CONDUIT, HE OR SHE SHALL USE ONE OR THE OTHER THROUGHOUT THE PROJECT. DO NOT MIX RIGID STEEL AND IMC CONDUIT.

Q. ALL OPENINGS WHERE CONDUIT PENETRATES WALLS OR FLOORS SHALL BE SEALED WATER AND AIRTIGHT.

R. CONNECTORS AND COUPLINGS FOR EMT CONDUIT IN WET OR DAMP LOCATIONS SHALL BE COMPRESSION TYPE. EMT FITTINGS MAY BE DIE-CAST METAL OR STEEL.

S. ALL CONDUIT SHALL BE UL LISTED AND LABELED FOR THE APPLICATION USED.

T. WHERE THE USE OF PVC CONDUIT IS INDICATED, ALL JOINTS SHALL BE SOLVENT WELDED WITH CEMENT FURNISHED BY THE CONDUIT MANUFACTURER. PROVIDE SUITABLE ADAPTERS WHERE PVC CONDUITS ARE COUPLED TO METALLIC CONDUITS. ALL ELBOWS SHALL BE MADE OF GALVANIZED RIGID STEEL CONDUIT.

U. ALL PVC CONDUITS INSTALLED BELOW GRADE SHALL BE ENCASED IN A 3" CONCRETE ENVELOPE.

V. METAL CLAD CABLE MAY BE USED INSIDE CANOPY PANELS.

## BUILDING WIRE, CABLE, AND CONNECTORS

A. BUILDING WIRE AND CONNECTORS SHALL BE UL LISTED AND LABELED. COMPLY WITH NEMA, ICEA, ANSI AND ASTM STANDARDS PERTAINING TO MATERIALS, CONSTRUCTION AND TESTING OF BUILDING WIRE AND CABLE.

B. EXCEPT AS OTHERWISE INDICATED, PROVIDE WIRE, CABLE AND CONNECTORS OF MANUFACTURER'S STANDARD MATERIALS, AS INDICATED BY PUBLISHED PRODUCT INFORMATION, DESIGNED AND CONSTRUCTED AS RECOMMENDED BY MANUFACTURER AND AS REQUIRED FOR THE INSTALLATION.

C. PROVIDE FACTORY FABRICATED 600 VOLT INSULATED BUILDING WIRE OF SIZES, RATINGS, MATERIALS, AND TYPES INDICATED BELOW:

UL TYPE: THHN/THWN
MATERIAL: COPPER
CONDUCTORS: #10 AWG AND SMALLER: SOLID OR STRANDED
CONDUCTORS: #8 AWG AND LARGER CONCENTRIC-LAY-STRANDED (STANDARD FLEXIBILITY)

D. CONDUCTOR IDENTIFICATION: CONDUCTORS SHALL BE IDENTIFIED BY COLOR AS FOLLOWS:

208Y/120
VOLT SYSTEMS

| | |
|---|---|
| A PHASE | BLACK |
| B PHASE | RED |
| C PHASE | BLUE |
| NEUTRAL | WHITE |
| EQUIPMENT GROUND | GREEN |
| ISOLATED GROUND | GREEN W/ YELLOW STRIPE |

E. COLOR FOR CONDUCTORS #10 AWG AND SMALLER SHALL BE PERMANENT FACTORY APPLIED. CONDUCTORS #8 AWG AND LARGER SHALL BE BLACK COLOR CODED PHASE TAPE APPLIED AT THE TERMINATIONS. WHERE TYPE MC CABLE IS USED, CIRCUIT NUMBERS SHALL BE APPLIED AT ALL WIRE SPLICES AND TERMINATIONS.

F. INSTALL ELECTRICAL BUILDING WIRES AND CABLES, AS INDICATED, IN COMPLIANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS, APPLICABLE REQUIREMENTS OF NEC, AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES.

G. WIRE SHALL BE PROTECTED DURING STORAGE AND HANDLING AND SHALL BE IN FIRST CLASS CONDITION WHEN INSTALLED.

H. NO GREASE OF ANY KIND AND NO COMPOUND OTHER THAN A NEUTRAL LUBRICANT AS APPROVED BY THE WIRE OR CABLE MANUFACTURER SHALL BE USED AS A PULLING COMPOUND.

I. WHEN WIRES ARE INSTALLED IN CONDUIT, SUFFICIENT SLACK SHALL BE ALLOWED TO PERMIT THE CONNECTION OF FIXTURES OR WIRING DEVICES WITHOUT ADDITIONAL SPLICE.

J. ALL CONDUCTORS SHALL BE CONTINUOUS FROM OUTLET TO OUTLET OR FROM PANEL TO OUTLET OR DEVICE. NO SPLICES WILLBE PERMITTED IN CONDUIT RUNS.

K. AT EACH OUTLET LOCATION, THE TERMINATING CONDUCTORS SHALL BE LEFT NOT LESS THAN 8" LONG WITHIN THE OUTLETS.

L. USE PULLING MEANS, INCLUDING FISH TAPE, CABLE, OR ROPE WHICH CANNOT DAMAGE RACEWAY.

M. TORQUE ALL BOLTED LUGS AND CONNECTORS TO TORQUE VALUES RECOMMENDED BY THE EQUIPMENT MANUFACTURER. WHERE TORQUE VALUES ARE NOT GIVEN, USE APPLICABLE TORQUE VALUES GIVEN BY UL STANDARDS #486A AND #486B.

N. AS FAR AS POSSIBLE, CONDUCTORS SHALL BE PULLED THROUGH WITHOUT SPLICE. WHERE SPLICES ARE NECESSARY AND APPROVED BY THE ENGINEER, THEY SHALL BE MADE IN JUNCTION OR PULL BOXES ONLY.

O. MINIMUM SIZE BRANCH CIRCUIT CONDUCTOR SHALL BE #12 AWG.

P. FIELD CONNECTIONS AT PANELBOARDS SHALL PROVIDE THE PROPER PHASE RELATIONSHIP, AS INDICATED ON THE DRAWINGS, OR AS SPECIFIED HEREIN.

## BOXES AND FITTINGS

A. IN GENERAL, APPLICATION OF ELECTRICAL BOX AND ELECTRICAL FITTING WORK IS INDICATED BY THE DRAWINGS, SCHEDULES AND THESE SPECIFICATIONS. PROVIDE ADDITIONAL ELECTRICAL BOXES AND FITTINGS AS MAY BE REQUIRED FOR A COMPLETE ELECTRICAL INSTALLATION.

B. TYPES OF ELECTRICAL BOXES AND FITTINGS IN THIS SECTION INCLUDE THE FOLLOWING:

1. OUTLET BOXES
2. JUNCTION BOXES
3. PULL BOXES
4. CONDUIT BODIES
5. BUSHINGS
6. LOCKNUTS

C. COMPLY WITH NEC AS APPLICABLE TO CONSTRUCTION AND INSTALLATION OF ELECTRICAL WIRING BOXES AND FITTINGS.

D. PROVIDE ELECTRICAL BOXES AND FITTINGS WHICH HAVE BEEN UL LISTED AND LABELED AND COMPLY WITH THE FOLLOWING STANDARDS:

1. STANDARD NO. 50: ELECTRICAL CABINETS AND BOXES
2. ANSI C 134.1 SHEET STEEL OUTLET BOXES, DEVICE BOXES, COVERS AND BOX SUPPORTS.

E. PROVIDE GALVANIZED PRESSED STEEL INTERIOR OUTLET WIRING BOXES, OF TYPES, SHAPES, AND SIZES, INCLUDING BOX DEPTHS, TO SUIT EACH RESPECTIVE LOCATION AND INSTALLATION, AND WITH THREADED SCREW HOLES WITH CORROSION RESISTANT SCREWS FOR SECURING BOX COVERS AND WIRING DEVICES.

F. PROVIDE OUTLET BOX ACCESSORIES AS REQUIRED FOR EACH INSTALLATION, INCLUDING MOUNTING BRACKETS, WALL BOARD HANGERS, EXTENSION RINGS, FIXTURE STUDS, CABLE CLAMPS, AND METAL STRAPS FOR SUPPORTING OUTLET BOXES, WHICH ARE COMPATIBLE WITH OUTLET BOXES BEING USED AND WHICH FULFILL REQUIREMENTS OF INDIVIDUAL WIRING SITUATIONS.

G. SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRESSED STEEL OUTLET BOXES OF ONE OF THE FOLLOWING:

1. CROUSE-HINDS CO.
2. STEEL CITY

H. PROVIDE CORROSION