ELECTRICAL SYMBOL LEGEND

SOME SYMBOLS AND ABBREVIATIONS MAY NOT BE USED FOR THIS PROJECT.

UPDATED: 08-07-2025

A. GENERAL

- JUNCTION BOX (4" SQUARE MINIMUM)
- INDICATES HOMERUN.
- CIRCUIT CONDUCTORS. LONG DASH INDICATES NEUTRAL CONDUCTOR, SHORT DASH INDICATES PHASE CONDUCTORS. CODE SIZED EQUIPMENT GROUND NOT INDICATED BUT REQUIRED.
- ISOLATED GROUNDING CONDUCTOR. GREEN, INSULATED WITH YELLOW STRIPE.
- GROUNDING CONDUCTOR. GREEN, INSULATED, SIZE PER PLAN.
- SURFACE PANELBOARD
- FLUSH PANELBOARD
- TRANSFORMER. (KVA SIZE AS NOTED). GROUNDING SYSTEM TO BUILDING STEEL (IF APPLICABLE).
- CONDUIT STUB-UP ABOVE CEILING
- CONDUIT STUB-DOWN TO FLOOR BELOW
- CONDUIT IN UNDERGROUND/SLAB
- CONDUIT STUB-UP WITH CAP
- CONDUIT SEAL-OFF
- FLEXIBLE CONDUIT. PROVIDE LIQUID TIGHT FLEX IN WET OR EXTERIOR LOCATIONS AND AT CONNECTIONS TO VIBRATING EQUIPMENT AND/OR TRANSFORMERS.
- CONDUIT CONCEALED IN WALLS OR ABOVE CEILING.

B. POWER

- 20A SPEC GRADE SINGLE RECEPTACLE MOUNTED AT +15" TO BOTTOM OR AS NOTED
- 20A SPEC GRADE DUPLEX RECEPTACLE MOUNTED AT +15" TO BOTTOM OR AS NOTED
- 20A SPEC GRADE FOURPLEX RECEPTACLE MOUNTED AT +15" TO BOTTOM OR AS NOTED
- 20A SPEC GRADE DUPLEX CONVENIENCE OUTLET MOUNTED ABOVE COUNTER. VERIFY EXACT HEIGHT WITH ARCHITECTURAL ELEVATIONS.
- 20A SPEC GRADE FOURPLEX CONVENIENCE OUTLET MOUNTED ABOVE COUNTER. VERIFY EXACT HEIGHT WITH ARCHITECTURAL ELEVATIONS.
- SPECIAL OUTLET AS NOTED ON DRAWINGS – VERIFY NEMA RATING BEFORE INSTALLATION
- CARBON MONOXIDE DETECTOR.
- SPECIAL OUTLET AS NOTED ON DRAWINGS.
  - X = C – MOUNTED IN CEILING; DW – DISHWASHER; SD – SOLAR DISPOSAL. PROVIDE SWITCH ABOVE COUNTER. MW – MICROWAVE; UCR – UNDERCOUNTER REFRIGERATOR; P – PEDISTAL MOUNTED; VM – VENDING MACHINE; PD – PEDIATRIC SAFE
- ISOLATED GROUNDING OUTLET AT +15" TO BOTTOM OR AS NOTED. "LEVITON" #5362-IG (ORANGE) RECEPTACLE WITH ISOLATED GROUND.
- 20A SPEC GRADE HALF SWITCHED DUPLEX RECEPTACLE AT +15" TO BOTTOM OR AS NOTED.
- DUAL COMPARTMENT POWER/TELE DATA POLE
- FLUSH FLOOR POWER OUTLET WITH FLUSH-IN-USE COVERS – WITH 20A SPEC GRADE RECEPTACLES DUPLEX OR FOURPLEX. HUBBELL, THOMAS & BETTS, CARLON OR EQUAL. RA FOR FLOOR SCRUB WATER.
- 20A SPEC GRADE GFCI DUPLEX RECEPTACLE AT +15" TO BOTTOM OR AS NOTED.
- 20A SPEC GRADE GFCI DUPLEX RECEPTACLE AT +6" ABOVE COUNTER TO BOTTOM OR AS NOTED.
- DROP CORD POWER OUTLET – WITH 20A SPEC GRADE RECEPTACLES DUPLEX OR FOURPLEX. HUBBELL, THOMAS & BETTS, CARLON OR EQUAL.
- "J" BOX FLUSH MOUNTED IN WALL FOR SYSTEMS FURNITURE POWER. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH SUPPLIER PRIOR TO ROUGH-IN. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR FINAL CONNECTION TO SYSTEM FURNITURE.
- WIRE MOLD. LENGTH AND TYPE AS NOTED ON DRAWINGS. MOUNT AS NOTED ON THE DRAWINGS.

C. COMMUNICATIONS

- FLUSH FLOOR COMBINATION TELEPHONE/DATA OUTLET – PROVIDE 1" MIN CONDUIT TO ABOVE ACCESSIBLE CEILING. HUBBELL, THOMAS & BETTS, CARLON OR EQUAL. RATED FOR SCRUB WATER.
- DATA OUTLET AT +15" A.F.F. TO BOTTOM OF WALL FIXTURE OR AS NOTED. PROVIDE 3/4" CONDUIT STUBBED TO +4" ABOVE FINISHED CEILING.
- TELEPHONE OUTLET AT +15" A.F.F. TO BOTTOM OF WALL FIXTURES OR AS NOTED. PROVIDE 3/4" CONDUIT STUBBED TO +4" ABOVE FINISHED CEILING OR AS NOTED:
  - X= P – PAY PHONE; W – WALL PHONE OUTLET MOUNTED AT +44" A.F.F.
- COMBINATION TELEPHONE/DATA OUTLET AT +15" A.F.F. TO BOTTOM OF WALL FIXTURES OR AS NOTED. PROVIDE 3/4"C. STUBBED TO +4" ABOVE FINISHED CEILING.
- DIGITAL CABLE TELEVISION OUTLET
- TELEVISION OUTLET WITH DEVICES
- "J" BOX FLUSH MOUNTED IN WALL FOR SYSTEMS FURNITURE TELE/DATA WITH 1-1/4" EMPTY CONDUIT STUBBED ABOVE CEILING. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH SUPPLIER PRIOR TO ROUGH-IN. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR FINAL CONNECTION TO SYSTEM FURNITURE.
- TELEPHONE TERMINAL BOARD "MB". 3/4" PLYWOOD TELEPHONE MOUNTING BOARD WITH #6 COPPER GROUND & DEDICATED FOURPLEX CONVENIENCE OUTLET. FURNISH IN ACCORDANCE WITH TELEPHONE COMPANY'S REQUIREMENTS. SIZE AS NOTED ON DRAWINGS. PLYWOOD SHALL BE TYPE "CDX".

D. LIGHTING

- STANDARD SWITCH AND COVER PLATE WITH LOCKING DEVICE (BRADY NO. 2AF98 OR EQUAL)
- SINGLE POLE SWITCH MOUNTED AT +44" TO CENTER OF DEVICE OR AS NOTED.
- TWO POLE SWITCH MOUNTED AT +44" TO CENTER OF DEVICE OR AS NOTED.
- THREE WAY SWITCH MOUNTED AT +44" TO CENTER OF DEVICE OR AS NOTED.
- FOUR WAY SWITCH MOUNTED AT +44" TO CENTER OF DEVICE OR AS NOTED.
- SINGLE POLE SWITCH WITH PILOT LIGHT AT +44" TO CENTER OF DEVICE OR AS NOTED.
- 2000W SLIDE CONTROL DIMMER AT AT +44" TO CENTER OF DEVICE OR AS NOTED.
- SWITCH KEY OPERATED MTD AT +44" TO CENTER OF DEVICE OR AS NOTED.
- LOW VOLTAGE SLIDE CONTROL DIMMER WITH PRESET AT +44". CONTRACTOR SHALL SUPPLY SPECIFIC (ELECTRONIC AND/OR MAGNETIC) TO SUIT LOADS.
- WALL MOUNTED OCCUPANCY SENSOR. LUTRON-DUAL TECHNOLOGY OR EQUAL. IN RESTROOMS: LUTRON-ULTRASONIC. PROGRAM: MANUAL ON/AUTO OFF UNLESS NOTED OTHERWISE.
- SINGLE POLE UP-OFF-DOWN SWITCH FOR CONTROL OF PROJECTION SCREEN. MOUNTED AT +44" TO CENTER OF DEVICE OR AS NOTED.
- LOW VOLTAGE PUSH BUTTON CONTROL STATION AS NOTED. VERIFY MOUNTING HEIGHT.
- ROOF MOUNTED PHOTOCELL (AIM NORTH) INTERMATIC #EK4136S OR EQUAL.
- ASTRONOMIC ELECTRONIC 4 POLE LIGHTING TIMESWITCH, INTERMATIC #ET2845CR OR EQUAL.
- CEILING MOUNTED OCCUPANCY SENSOR 360°. LUTRON-DUAL TECHNOLOGY OR EQUAL. IN RESTROOMS: LUTRON-ULTRASONIC. IN WAREHOUSE: LUTRON-HIGHBAY. (WR) WIDE ANGLE (LR) LONG RANGE.
- WALL/CEILING MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR SHALL BE PROGRAMMED AS VACANCY SENSOR. MANUAL ON/AUTO OFF.
- OCCUPANCY SENSOR – POWER PACK OR SLAVE PACK.
- LED STRIP LIGHTING FIXTURE – AS NOTED ON DRAWINGS.
- LED LIGHTING FIXTURE – AS NOTED ON DRAWINGS SURFACE MOUNTED.
- RECESSED GRID W/FLEXIBLE CONNECTION.
- INDICATES NIGHTLIGHT (NL) AND/OR EMERGENCY FIXTURE WITH 1400 LUMEN MINIMUM (UNSWITCHED) – AS NOTED ON DRAWING.
- WALL MOUNTED LIGHTING FIXTURE – AS NOTED ON DRAWINGS.
- CEILING MOUNTED LIGHTING FIXTURE – AS NOTE ON DRAWINGS.
- LED HIGH/LOW BAY FIXTURE
- WALL WASH LIGHTING FIXTURE. AIM AS DIRECTED BY ARCHITECT.
- TRACK LIGHTING SYSTEM WITH TRACK FIXTURE HEADS AS INDICATED ON PLANS. VERIFY TYPE LINE OR LOW VOLT.
- POLE MOUNTED AREA LIGHT (ARM MOUNTED) VERIFY HEIGHT SEE POLE DETAIL.
- POLE MOUNTED AREA LIGHT (POST TOP) VERIFY HEIGHT SEE POLE DETAIL.
- WALL PACK.
- SINGLE FACE EXIT SIGN, SEE LIGHTING FIXTURE SCHEDULE FOR SPECIFICATION. DIRECTIONAL ARROW AS INDICATED ON PLANS (CEILING OR WALL.)
- COMBINATION EMERGENCY EXIT SIGN WITH DUAL HEAD LIGHTS WITH EMERGENCY BATTERY BACK-UP.

D. LIGHTING CONTINUED

- DOUBLE FACE EXIT SIGN. SEE LIGHTING FIXTURE SCHEDULE FOR SPECIFICATION. DIRECTIONAL ARROW AS INDICATED ON PLANS (CEILING OR WALL)
- DUAL HEAD EMERGENCY BATTERY PACK. SEE LIGHTING FIXTURE SCHEDULE FOR SPECIFICATIONS.

E. MECHANICAL

- CONTACTOR – FURNISHED AND INSTALL BY OTHERS
- CONTACTOR – FURNISHED/INSTALLED BY ELECTRICAL CONTRACTOR SIZE AS NOTED
- MOTOR STARTER/CONTROLLER– FURNISHED WITH MOTOR.
- MOTOR STARTER/CONTROLLER – FURNISHED/INSTALLED BY ELECTRICAL CONTRACTOR.
- MOTOR – SIZE AS INDICATED ON DRAWINGS.
- DISCONNECT SWITCH – SIZE AND FUSES AS PER MANUFACTURER'S RECOMMENDATIONS (WEATHERPROOF WHERE OUTSIDE). N.F. INDICATES NON-FUSED.
- COMBINATION FUSIBLE DISCONNECT/MOTOR CONTROLLER – 30/3P WITH MIN. SIZE 1 MAGNETIC STARTER (UNLESS NOTED OTHERWISE). PROVIDE FUSES PER MANUFACTURER'S REQUIREMENTS. N.F. INDICATES NON-FUSED.
- HORSEPOWER RATED MANUAL MOTOR STARTER WITH THERMAL OVERLOAD(S). OVERLOAD HEATERS TO BE SIZED PER HORSEPOWER AND MANUFACTURER'S REQUIREMENTS.

F. FIRE ALARM

- FIRE ALARM PULL STATION AT +48".
- FIRE ALARM STROBE: +80" AFF OR 6" BELOW CEILING, WHICHEVER IS LOWER.
- FIRE ALARM HORN/STROBE: +80" AFF OR 6" BELOW CEILING, WHICHEVER IS LOWER.
- FIRE ALARM MAGNETIC DOOR HOLDER
- FIRE ALARM BELL
- FAAP – FIRE ALARM ANNUNCIATOR PANEL
- FACP – FIRE ALARM CONTROL PANEL
- FIRE ALARM HEAT DETECTOR.
- FIRE ALARM SMOKE DETECTOR.
- FIRE ALARM DUCT SMOKE DETECTOR.
- CARBON MONOXIDE DETECTOR.
- FIRE ALARM TAMPER SWITCH.
- FIRE ALARM FLOW SWITCH.
- SPEAKER.

G. ONE LINE DIAGRAM

- (M) METER, (S) SOCKET, (B) BLANK
- (M) METER, (S) SOCKET, (B) BLANK, WITH CURRENT TRANSFORMERS.
- BREAKER AS INDICATED.
- FUSED SWITCH.
- BREAKER WITH SHUNT TRIP (SIZE AS INDICATED)
- PULLOUT FUSE

H. SECURITY

- LOW VOLTAGE CARD READER WITH 3/4" EMPTY CONDUIT STUBBED INTO ACCESSIBLE CEILING SPACE
- LOW VOLTAGE KEYPAD
- SURVEILLANCE CAMERA

I. ABBREVIATIONS

AMPERE	
AIC	AVAILABLE INTERRUPTING CURRENT
AI	ALUMINUM
AFC	AVAILABLE FAULT CURRENT
AFCI	ARC FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AH	AIR HANDLER UNIT
APS	ARIZONA PUBLIC SERVICE – (UTILITY CO.)
C	CONDUIT
CCT	CORRECTED COLOR TEMP.
CRI	COLOR RENDERING INDEX
CU	COPPER
D	DEDICATED
DP	DUST – IGNITION PROOF
E	EXISTING
EC	EMPTY CONDUIT
EDF	ELECTRIC DRINKING FOUNTAIN
EF	EXHAUST FAN
EG	EQUIPMENT GROUND
EM	EMERGENCY LIGHT. BYPASS LOCAL SWITCHING AND PROVIDED BATTERY PACK.
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFP	GROUND FAULT PROTECTION
GND	GROUND/BOND CONDUCTOR
GWH	GAS WATER HEATER
IAW	IN ACCORDANCE WITH
IG	ISOLATED GROUND
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MLO	MAIN LUG ONLY
N	NEW ITEM
NR	NEW LOCATION OF RELOCATED EXISTING ITEM
NL	NIGHT LIGHT. BYPASS LOCAL SWITCHING.
PNL	PANELBOARD
R	EXISTING TO BE RELOCATED
SES	SERVICE ENTRANCE SECTION
SRP	SALT RIVER PROJECT – (UTILITY CO.)
SWBD	SWITCHBOARD
TEP	TUCSON ELECTRONIC POWER
TMB	3/4" PLYWOOD TELEPHONE MOUNTING BOARD WITH #6 CU. SOLID GROUND.
TTC	TELEPHONE TERMINAL CABINET (SIZE INDICATED ON DRAWINGS)
UFER	CONCRETE ENCASED ELECTRODE
UG	UNDERGROUND
UNO	UNLESS NOTED OTHERWISE
VA	VOLT AMPERES
W	WATT
WG	WIRE GUARD
WH	WATER HEATER
WP	WEATHERPROOF (RAIN TIGHT) WEATHER RESISTANT NEMA 3R OR NEMA 4 IN-USE
WR	WEATHER RESISTANT
X	EXISTING TO BE REMOVED
XP	EXPLOSION PROOF

ELECTRICAL SPECIFICATIONS

SOME SPECIFICATIONS MAY NOT BE USED FOR THIS PROJECT.

1.0 INTENT

1.1 FURNISH AND INSTALL A COMPLETE AND OPERATIONAL ELECTRICAL SYSTEM IN ACCORDANCE WITH PLANS AND SPECIFICATIONS.

1.2 ALL DRAWINGS ARE SCHEMATIC IN NATURE AND THE REQUIRED INSTALLATION IS NOT LIMITED TO WHAT IS SHOWN. ALL APPURTENANCES NECESSARY TO PROVIDE A COMPLETE AND OPERATIONAL SYSTEM MUST BE INCLUDED IN THE CONTRACTORS BID AND WORK.

2.0 GENERAL

2.1 THE CONTRACTOR SHALL VISIT THE JOB SITE AND FAMILIARIZE HIMSELF WITH ALL EXISTING CONDITIONS WHICH MAY AFFECT HIS BID OR WORK. NO ALLOWANCES WILL BE MADE FOR EXISTING CONDITIONS OR THE CONTRACTOR'S FAILURE TO ACCOMMODATE EXISTING CONDITIONS ON HIS BID.

2.2 IT IS THE CONTRACTORS RESPONSIBILITY TO OBTAIN CLARIFICATION OF ANY APPARENT CONFLICT OR INCONSISTENCY IN THE DRAWINGS, SPECIFICATION, OR DESIGN, PRIOR TO HIS BID AND IN WRITING WITH THE ENGINEER. OTHERWISE THE CONTRACTOR ACCEPTS RESPONSIBILITY TO CORRECT (AT HIS COST) ANY SUCH ITEMS TO MEET THE INTENT AS INTERPRETED BY THE ENGINEER.

2.3 ALL MATERIAL AND WORKMANSHIP SHALL CONFORM TO THE MOST RECENT ADOPTED EDITIONS OF THE NFPA, NATIONAL ELECTRIC CODE, IBC, APPLICABLE CITY AND STATE CODES AND ORDINANCES, THE AMERICANS WITH DISABILITIES ACT, E.P.A. REGULATIONS (INCLUDING EPACT 1992), INTERNATIONAL ENERGY CONSERVATION CODE (IECC)/TITLE 24/ASHRAE 90.1 AND UTILITY COMPANY REQUIREMENTS. THE FOREGOING CODES AND REGULATIONS ARE MINIMUM STANDARDS AND ARE INCORPORATED IN THIS SPECIFICATION FOR THIS WORK BY REFERENCE.

2.4 THE CONTRACTOR SHALL COORDINATE AND PROVIDE INFORMATION AS REQUIRED TO ALL SERVING UTILITIES IN A TIMELY MANNER AS NECESSARY TO PROVIDE THE SERVICE REQUIRED AND MEET UTILITY REQUIREMENTS. IMMEDIATE COORDINATION WILL BE REQUIRED FOR MOST PROJECTS. FIELD COORDINATE ALL REQUIREMENTS WITH UTILITY CO. PRIOR TO PROCUREMENT.

2.5 REFER TO ARCHITECTURAL, MECHANICAL, CIVIL, STRUCTURAL, AND/OR EQUIPMENT SUPPLIERS DRAWINGS AND SPECIFICATIONS FOR EXACT EQUIPMENT LOCATIONS, LOADS AND ADDITIONAL REQUIREMENTS. REPRESENTATIONS OF THE WORK SPECIFIC TO THE OTHER DISCIPLINES IS SHOWN ON THE ELECTRICAL DRAWINGS FOR CLARITY ONLY. THE CONTRACTOR ASSUMES RESPONSIBILITY FOR ALL EQUIPMENT AND SUPPLIES. ALL EQUIPMENT SHALL BE INSTALLED STRICTLY PER MANUFACTURERS RECOMMENDATIONS. OTHERWISE THE CONTRACTOR ASSUMES RESPONSIBILITY (AT HIS COST) TO CORRECT AND REMEDY ANY INSTALLATION NOT IN COMPLIANCE WITH THE MANUFACTURES RECOMMENDATIONS AND INTENTIONS AS INTERPRETED BY THE ENGINEER.

2.7 ANY VARIANCE OR EXCEPTIONS TO THE DRAWINGS AND SPECIFICATIONS MUST BE REQUESTED AND APPROVED IN WRITING. INTERIM VERBAL APPROVALS WILL NOT BE PROVIDED WHEN THE ENGINEER DETERMINES THIS TO BE JUSTIFIED AND MUST BE CONFIRMED IN WRITING TO BE FINAL.

2.8 THE CONTRACTOR IS RESPONSIBLE TO OBTAIN ALL NECESSARY PERMITS, VARIANCES, AND APPROVALS, ETC. PRIOR TO PROCEEDING WITH THE WORK AND PAYING FOR THE COST OF THIS WORK.

2.9 PRIOR TO ROUGH-IN, THE ELECTRICAL CONTRACTOR SHALL COORDINATE THE EXACT LOCATION OF ALL LIGHT FIXTURES AND WIRING DEVICES: TO INCLUDE MOUNTING HEIGHT AND LOCATION WITH ARCHITECTURAL ELEVATIONS. ANY CONFLICTS SHALL BE REPORTED TO THE ENGINEER/ARCHITECT.

2.10 THE ELECTRICAL CONTRACTOR SHALL PROVIDE EQUIPMENT AND SUPPORT FOR PROGRESS AND FINAL INSPECTIONS. THIS INCLUDES COMPLETE ACCESS TO ALL EQUIPMENT. ADDITIONALLY A COMPLETE SET OF SHOP DRAWINGS, FUSE LISTS FOR FUSES USED AND A 5% SUPPLY OF ALL LIGHT BULBS PROVIDED IN FIXTURES (TO A MAXIMUM OF 15 FOR EACH STYLE) SHALL BE PROVIDED TO THE OWNER AT FINAL INSPECTION.

2.11 RECONSTRUCTION OF EXISTING FACILITIES AND EQUIPMENT SHALL REQUIRE COMPLETE RENOVATION (MAKE GOOD AS NEW) FOR ALL EXISTING EQUIPMENT UPON WHICH WORK IS PERFORMED EXCEPT WHEN EQUIPMENT WHICH IS AFFECTED BY THE WORK PERFORMED. THIS WILL INCLUDE THESE FOLLOWING PROVISIONS:

2.11.1 VERIFICATION OF EXISTING SES COMPLIANCE WITH NEC "GROUNDING" ARTICLES.

2.12 VERIFICATION OF CABLE SIZE AND AMPACITY OF EXISTING FEEDERS AND BRANCH CIRCUITS WITH NEW LOADS.

2.11.3 EXISTING LIGHT FIXTURES TO BE REUSED MUST BE CLEANED, RE-LAMPED, AND RESTORED TO "LIKE NEW" CONDITION.

2.11.4 EXISTING PANEL BOARDS, SWITCH BOARDS, AND TRANSFORMERS WHICH ARE INCLUDED IN THE PROJECT WORK SHALL HAVE PREVENTATIVE MAINTENANCE PERFORMED TO INCLUDE RE-TORQUING OF ALL LUGS, CLEANING AND INSPECTION.

2.11.5 VERIFY PROPER WORKING CONDITION OF ALL EXISTING EMERGENCY FIXTURES AND EXIT SIGNS. REPAIR OR REPLACE AS REQUIRED.

IN THE EVENT THAT INSPECTION REVEALS DISCREPANCIES AND/OR NONCOMPLIANCE THE OWNER AND THE ENGINEER SHALL BE NOTIFIED IN WRITING, AND EQUIPMENT BROUGHT INTO COMPLIANCE.

3.0 MATERIALS AND METHODS

3.1 THE USE OF **EMT** IS ACCEPTABLE IN ACCORDANCE WITH NEC ARTICLE "ELECTRICAL METALLIC TUBING". EMT SHALL NOT BE USED WHERE IT IS SUBJECT TO SEVERE PHYSICAL DAMAGE. EMT SHALL BE COMPRESSION TYPE. MINIMUM TRADE SIZE CONDUIT SIZE IS 1/2" AND 3/4" FOR HOME RUNS.

3.2 **GROUNDING** SHALL BE COPPER (98 % CONDUCTIVITY). MINIMUM LINE VOLTAGE WIRE SIZE IS #12 A.W.G. #6 AND SMALLER SHALL HAVE THHN/THHW INSULATION. #4 AND LARGER SHALL HAVE XHHW/XHHW-2 INSULATION. ALL CONDUCTORS SHALL HAVE 90° RATED INSULATION. ALL COPPER, 20A BRANCH CIRCUIT CONDUCTORS (#12) OVER 100' IN LENGTH TO BE #10'S MINIMUM. ALL 277V, 20A BRANCH CIRCUIT CONDUCTORS (#12) OVER 75' IN LENGTH TO BE #10'S MINIMUM.

3.3 WHEN SEPARATE BRANCH CIRCUIT NEUTRAL CONDUCTORS ARE USED WITH EACH PHASE CONDUCTOR OR SYSTEMS FURNITURE IS INDICATED, THE MINIMUM NEUTRAL CONDUCTOR SIZE SHALL BE #10 A.W.G. STRANDED COPPER.

3.4 ALL WIRING DEVICES SHALL BE OF A CONSISTENT HEIGHT AND INCLUDE PROTECTION FOR RECEPTACLES AND SWITCHES). HUBBELL, PASS & SEYMOUR, BRYANT, OR LEVITON ARE ACCEPTABLE. ALL SPECIAL RECEPTACLE PLUGS FOR ALL PRESTANDING ELECTRICAL SERVICE ENTRANCE EQUIPMENT PER LOCAL UTILITY COMPANY SPECIFICATIONS.

3.5 **CIRCUIT NUMBER.**

3.6 COVER PLATES AND DEVICES SHALL BE PHENOLIC PLASTIC (WHITE OR COLOR SELECTED BY ARCHITECT/OWNER) /OR LIVING AREAS, AND SHALL BE GALVANIZED STEEL IN WAREHOUSE/INDUSTRIAL/MANUFACTURING AREAS OR AREAS SUBJECT TO PHYSICAL ABUSE.

3.6 ALL CONDUCTORS TO BE CONCEALED EXCEPT TO SURFACE MOUNTED PANELS AND AT THE CEILING OF EXPOSED STRUCTURE AREAS. CONDUITS WILL BE RUN PARALLEL OR PERPENDICULAR TO BUILDING LINES.

3.7 ELECTRIC METAL CONDUIT (SEAL TITE FOR EXTERIOR APPLICATIONS) SHALL BE USED FOR CONNECTIONS TO EQUIPMENT SUBJECT TO VIBRATION (E.G. MOTORS) WITH A MAX. OF 6ft.

3.8 THE USE OF **MC CABLE** IS ACCEPTABLE (UPON OWNER NOTIFICATION AND APPROVAL) AND MAY BE USED IN ACCORDANCE WITH NEC ARTICLE "METAL-CLAD CABLE: TYPE MC". BUT LIMITED TO USE FOR CONCEALED BRANCH CIRCUITS ONLY. ADDITIONALLY MC CABLE MAY NOT BE USED FOR HOME RUNS OR OUTDOORS.

3.9 NON-METALLIC CONDUIT (MIN. SCHEDULE 40) MAY BE USED ONLY IN OR UNDER SLABS & IN CONCRETE OR MASONRY WALLS. MIN. 24" COVER REQUIRED FOR UNDERGROUND USE.

3.10 **FUSES** SHALL BE BUSSMAN, LITTLEFUSE, OR GOULD SHAWMUT.

3.11 CONDUCTORS WILL BE SOLID AND/OR STRANDED WITH INSULATION CONTINUOUSLY COLOR COATED UP TO AND INCLUDING SIZE #6 A.W.G. GROUNDING/BONDING CONDUCTORS SHALL BE U.L. LABELED ROPE STRAND.

3.12 CONNECTIONS OR SPLICES SHALL BE EXOTHERMIC WELD (CAD WELD OR THOMAS AND BETTS FURSEWELD) FOR GROUNDING/BONDING CONDUCTORS.

3.13 NEW CONDUCTORS SHALL BE CONTINUOUS. HYDRAULIC CRIMP SPLICES OR CONNECTIONS ARE EXCEPTIONS AND REQUIRE SPECIFIC APPROVAL IN WRITING BY HAWKINS DESIGN GROUP.

3.14 ALL CONDUIT SUPPORT SYSTEMS SHALL BE INSTALLED ON THE BUILDING STRUCTURE. UNISTRUT, BEELINE, SUPERSTRUT STEEL CITY SPRING STEEL FASTENERS OR CADDY MOUNTING SYSTEMS ARE ACCEPTABLE. NO CONDUIT WILL BE SUPPORTED BY THE CEILING WIRES, TIE WIRE OR GRID SYSTEM. PERFORATED STRAPS OR OTHER PIPING AND CONDUIT STRAPS ARE NOT ACCEPTABLE SUPPORTS.

3.15 ACCEPTABLE MANUFACTURES FOR **SWITCH GEAR, DISTRIBUTION GEAR** AND RELATED COMPONENTS ARE: EATON, SQUARE D, ACME TRANSFORMERS, ABB, SIEMENS, HAMMOND POWER SOLUTIONS, AND CUTLER-HAMMER.

3.16 CONDUCTORS SHALL BE COLOR CODED FOR BRANCH CIRCUITS AND PHASE LEGS OF FEEDERS TO PANEL BOARDS, SWITCHBOARDS, ETC. IN ACCORDANCE WITH NEC AND LOCAL MUNICIPAL REQUIREMENTS. COLOR REQUIREMENTS INCLUDE THE FOLLOWING.

- 120-V, 2-WIRE CIRCUIT: GROUNDED NEUTRAL–WHITE; UNGROUNDED LEG–BLACK.
- 208Y/120-V, 3-PHASE, 4-WIRE: GROUNDED NEUTRAL–WHITE;PHASE A–BLACK; PHASE B–RED; PHASE C–BLUE.
- 240/120-V, 3 WIRE, SINGLE PHASE CIRCUIT: GROUNDED NEUTRAL–WHITE; PHASE A–BLACK; PHASE B–RED.
- 240-V, DELTA, 3-PHASE, 3-WIRE: PHASE A–BLACK; PHASE B–RED; PHASE C–BLUE.
- 240/120-V, 3-PHASE, 4-WIRE, HIGH-LEG DELTA: GROUNDED NEUTRAL–WHITE;HIGH LEG (208-V TO NEUTRAL)–ORANGE; PHASE A–BLACK; PHASE C–BLUE.
- 480Y/277-V, 3-PHASE, 4-WIRE: GROUNDED NEUTRAL–GRAY;PHASE A–BROWN; PHASE B–ORANGE; PHASE C–YELLOW.
- 480-V, DELTA, 3-PHASE, 3-WIRE: PHASE A–BROWN; PHASE B–ORANGE; PHASE C–YELLOW.
- 480-V, DELTA, 3-PHASE, 3-WIRE: PHASE A–BROWN; PHASE B–ORANGE; PHASE C–YELLOW.
- EQUIPMENT GROUNDING CONDUCTORS–GREEN; ISOLATED GROUNDS–GREEN WITH A YELLOW STRIPE.

3.17 ALL INSTALLATIONS WITHIN PLENUM RATED CEILING SPACE SHALL BE IN ACCORDANCE WITH NEC ARTICLE "WIRING METHODS" WITH REGARDS TO SMOKE DEVELOPMENT AND FLAME SPREAD.

3.18 ALL UNDERGROUND CABLE, PIPE AND CONDUITS SHALL BE DETECTABLE (METALLIC) OR HAVE A DETECTABLE UNDERGROUND LOCATION DEVICE INSTALLED WITH IT. THE RECOMMENDED DETECTABLE UNDERGROUND LOCATION DEVICE IS A #18 OR LARGER COPPER TRACER WIRE SECURELY ATTACHED TO THE TOP OF ANY NON-METALLIC CABLE, PIPE OR CONDUIT AT 8'-0" O/C AND SHALL HAVE A MINIMUM OF 12" OF TRACER WIRE ACCESSIBLE AT ALL ABOVE GRADE TERMINATIONS.

3.19 ALL HORIZONTAL UNDERGROUND CONDUIT RUNS (INCLUDING UNDER CONCRETE SLABS) SHALL BE A MINIMUM OF 24" BELOW GRADE.

3.20 ALL MATERIAL & DEVICES USED EXTERIOR OF THE BUILDING SHALL BE LISTED U.L. FOR WATERPROOF APPLICATIONS.

4.0 SUBMITTALS

4.1 SUBMIT 6 SETS OF SHOP DRAWINGS AND SAMPLES FOR ALL EQUIPMENT PRIOR TO ORDERING IN A TIMELY MANNER. SUBMITTALS SHALL INCLUDE LIGHT FIXTURES (INCLUDING LIGHT POLES), LIGHTING CONTROLS, SWITCHBOARDS, PANELBOARDS, BREAKERS, STARTERS, HVAC ELECTRICAL EQUIPMENT AND TRANSFORMERS.

4.1.1 SHOP DRAWINGS SHALL INCLUDE LAYOUT DIMENSIONS AND IDENTIFICATION OF SPECIFIC EQUIPMENT FOR INSTALLATION, MINIMUM NEC CLEARANCES SHALL BE INDICATED.

4.1.2 THE CONTRACTOR SHALL INCLUDE COMPARISON DATA AND SAMPLES FOR BOTH THE SUBSTITUTE AND SPECIFIED ITEM, WHEN SUBSTITUTIONS ARE PROPOSED. THE CONTRACTOR REMAINS RESPONSIBLE TO PROVIDE THE ORIGINALLY SPECIFIED INSTALLATION IN ACCORDANCE WITH THE ORIGINAL DELIVERY DATE (AT HIS COST) WHEN SUBSTITUTIONS ARE NOT APPROVED.

4.2 THE CONTRACTOR SHALL PROVIDE PROOF OF PERFORMANCE BOND WITH HIS INITIAL SUBMITTALS (E.G. SHOP DRAWINGS) TO INCLUDE WARRANTY FOR THE WARRANTY PERIOD (2 YEARS).

4.3 THE CONTRACTOR SHALL SUBMIT COMPLETE AND ACCURATE "AS BUILT" DRAWING TO THE OWNER AND ENGINEER WITHIN 2 WEEKS OF OWNER ACCEPTANCE. PROVIDE 4 SETS OF BLUELINES OR EQUIVALENT. FAILURE TO COMPLY WILL RESULT IN WITHHOLDING OF PAYMENTS DUE, AND ASSESSMENT OF CHARGES (AGAINST THE CONTRACTOR) FOR AS-BUILT DRAWINGS BY THE ENGINEER AT THE CURRENT HOURLY RATE.

4.4 PROVIDE A LETTER TO THE OWNER AND ENGINEER CERTIFYING ALL EQUIPMENT AND TERMINATIONS ARE PROPERLY TORQUED. THIS CERTIFICATION SHALL BE EXECUTED BY A LICENSED CONTRACTOR, AND WRITTEN CERTIFICATION PROVIDED ON COMPANY LETTERHEAD.

4.5 PROVIDE 2 COPIES OF ALL MANUFACTURER/SUPPLIER WARRANTIES AND GUARANTEES TO THE OWNER WITHIN 2 WEEKS OF FINAL ACCEPTANCE BY THE OWNER.

4.6 **TESTS**

4.6.1 SUBMIT 2 COPIES OF ALL INDEPENDENT TEST RESULTS FOR THE ELECTRICAL POWER DISTRIBUTION SYSTEM AS A COMPLETE PACKAGE TO THE OWNER AND ENGINEER. PACKAGE MUST PROVIDE SPECIFIC VALUES OF TEST DATA OBTAINED AGAINST ACCEPTABLE STANDARDS AND ARE INCORPORATED IN THIS SPECIFICATION.

4.6.2 TESTING PERSONAL SHALL BE CERTIFIED BY THE NATIONAL ELECTRIC TESTING ASSOCIATION (NETA) OR NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET).

4.6.3 ALL TESTING SHALL BE DONE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS OR NATIONALLY RECOGNIZED STANDARDS AND PRACTICES.

4.6.4 GROUNDING SYSTEM FALL OF POTENTIAL (RESISTANCE TO GROUND) TESTING.

4.6.4.1 GROUND SHALL PROVIDE 5 OHMS OR LESS RESISTANCE TO GROUND AND LESS THAN 0.5 OHMS POINT-TO-POINT BETWEEN THE MAIN GROUNDING ELECTRODE SYSTEM AND ELECTRICAL EQUIPMENT FRAMES, SYSTEM NEUTRAL AND/OR DERIVED NEUTRAL POINTS (REFERENCE IEEE STANDARDS 142 AND 81–1983) AND SHALL NOT BE PERFORMED WITHIN 24 HOURS AFTER RAINFALL.

4.6.5 OVER-POTENTIAL (HI-POT) TESTING

4.6.5.1 SHALL BE PERFORMED ON ALL BUSSES 1000A OR GREATER OR ON MODIFICATIONS OF SERVICES GREATER THAN 400A.

4.6.5.2 TEST BOTH PHASE-TO-PHASE AND PHASE-TO-GROUND FOR AT LEAST ONE MINUTE.

4.6.6 GROUND FAULT PROTECTION TESTING

4.6.6.1 PROVIDE GROUND-FAULT PROTECTION TESTING BY CURRENT INJECTION AT SENSOR.

4.6.6.2 TEST PRIMARY CONTROL VOLTAGE TO NOT EXCEED 57