

# ELECTRICAL SPECIFICATIONS

## 1-BASIC ELECTRICAL REQUIREMENTS

- 1.1 QUALITY ASSURANCE**
- A. ALL ELECTRICAL COMPONENTS AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE FOLLOWING CODES (LATEST EDITION ADOPTED BY THE AUTHORITY HAVING JURISDICTION):
    1. THE NATIONAL ELECTRICAL CODE (NFPA-70).
    2. THE NATIONAL ELECTRICAL SAFETY CODE (ANSI C-2).
    3. INTERNATIONAL BUILDING CODE.
    4. ICC (INTERNATIONAL CODE COUNCIL) ELECTRICAL CODE.
  - B. ALL MATERIALS SHALL BE NEW AND SHALL CONFORM TO STANDARDS WHERE SUCH HAVE BEEN ESTABLISHED FOR THE PARTICULAR MATERIAL. ALL UL LISTED EQUIPMENT SHALL BEAR THE UL LABEL.
  - C. GUARANTEE TO MAKE GOOD ALL DEFECTS IN MATERIAL EQUIPMENT AND WORKMANSHIP DISCLOSED WITHIN A PERIOD OF ONE (1) YEAR FROM DATE OF BUILDING ACCEPTANCE BY THE OWNER.
  - D. APPROVED EQUALS MAY BE SUBSTITUTED FOR ALL EQUIPMENT SPECIFIED BY MANUFACTURERS AND CATALOG NUMBERS IF ALLOWED BY THE ENGINEER. HOWEVER, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVE SUCH EQUALITY TO THE ENGINEER. THE ENGINEER'S APPROVAL OR DISAPPROVAL OF THE EQUIPMENT SUBMITTAL SHALL BE FINAL AND BINDING.
- 1.2 PERMITS**
- A. OBTAIN ALL PERMITS AND INSPECTIONS REQUIRED FOR THE WORK INVOLVED. DELIVER TO THE OWNER ALL CERTIFICATES OF INSPECTION.
- 1.3 DRAWINGS**
- A. THE DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF ELECTRICAL EQUIPMENT. COORDINATE INSTALLATION OF EQUIPMENT WITH ALL OTHER TRADES. DO NOT SCALE DRAWINGS FOR CONNECTION LOCATIONS.
- 1.4 CIRCUIT LABELING**
- A. PANELBOARD CIRCUIT DESCRIPTIONS SHALL BE PROVIDED TO DESCRIBE THE LOAD SERVED BY EACH CIRCUIT. PROVIDED TYPE WRITTEN PANEL CIRCUIT DIRECTORY FOR EACH PANELBOARD.
- 1.5 DISTRIBUTION EQUIPMENT LABELING**
- A. PROVIDE AN ENGRAVED 3-PLY, PHENOLIC NAMEPLATE WITH ENGRAVED WHITE LETTERING ON BLACK BACKGROUND.
  - B. EQUIPMENT SHALL INCLUDE THE FOLLOWING:
    1. DISCONNECT SWITCH
    2. PANELBOARD

## 2-BASIC MATERIALS

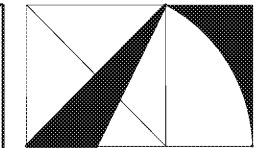
- 2.1 RACEWAYS**
- A. PROVIDE CONDUITS SEALS WHEN GOING FROM CONDITIONED SPACE TO NON-CONDITIONED SPACE AND IN CLASSIFIED CLASS 1, DIV 1 OR DIV 2 AREAS WHERE APPLICABLE.
  - B. RACEWAY IS REQUIRED FOR ALL WIRING, UNLESS SPECIFICALLY INDICATED OR SPECIFIED OTHERWISE. "THE MINIMUM SIZE OF CONDUIT SHALL BE 3/4" AND SHALL NOT BE LESS THAN SIZE INDICATED ON THE DRAWINGS OR REQUIRED BY THE NEC.
  - C. CONDUITS SHALL BE PVC COATED RIGID GALVANIZED STEEL (RGS) EXCEPT FOR THE FOLLOWING CONDITIONS:
    1. USE FLEXIBLE CONDUIT FOR CONNECTIONS TO MOTORS, LUMINAIRES, AND ALL VIBRATING EQUIPMENT.
      - a. LENGTH SHALL NOT EXCEED 18", EXCEPT LENGTHS UP TO 10'-0" MAY BE USED FOR LUMINAIRES
      - b. MAINTAIN GROUND CONTINUITY THROUGH FLEXIBLE CONDUIT WITH A GREEN EQUIPMENT CONDUCTOR.
    2. USE ELECTRIC METALLIC TUBING (EMT) IN OFFICE AREAS AND SHOP AREAS ABOVE 15'-0" AND WHERE CONCEALED ABOVE 10'-0" AFF IN CEILINGS AND IN WALLS. CONDUITS SHALL BE RUN CONCEALED IN FINISHED OFFICE SPACES.
    3. USE SCHEDULE 40 PVC WHERE INDICATED ON PLAN DRAWING OR ON SECTIONS AND AT A MINIMUM OF 30" BELOW GRADE UNLESS NOTED OTHERWISE.
  - D. EMT CONDUIT COUPLINGS AND CONNECTORS SHALL BE STEEL RAIN-TIGHT TYPE OR COMPRESSION TYPE WHERE AND WHEN PERMITTED. ALL EMT CONNECTORS SHALL BE INSULATED THROAT TYPE. GRS FITTINGS SHALL BE STANDARD THREADED COUPLINGS, LOCKNUTS, BUSHINGS AND ELBOWS. ALL GRC AND IMC FITTINGS SHALL BE STEEL OR MALLEABLE IRON. SET SCREW OR NON-THREADED FITTINGS ARE NOT PERMITTED. NON-METALLIC CONDUIT FITTINGS SHALL BE OF THE SAME MATERIAL AS THE CONDUIT FURNISHED AND SHALL BE THE PRODUCT OF THE SAME MANUFACTURER.
  - E. ALL CONDUIT SUPPORT PARTS AND HARDWARE SHALL BE HOT-DIPPED GALVANIZED. CONDUIT STRAPS SHALL BE SINGLE HOLE CAST METAL TYPE OR TWO HOLE GALVANIZED METAL TYPE. CONDUIT SUPPORT CHANNELS SHALL BE 1/2" X 1/2" #14 GAUGE CHANNEL, WITH 1/4" THREADED STEEL RODS USED FOR SUSPENSION. WIRE OR CHAIN IS NOT ACCEPTABLE FOR CONDUIT HANGERS. INDIVIDUAL CONDUIT HANGERS SHALL BE GALVANIZED SPRING STEEL SPECIFICALLY DESIGNED FOR THE PURPOSE. INDIVIDUAL CONDUIT STRAPS ON METAL STUDS SHALL BE SPRING STEEL AND SHOULD WRAP AROUND THE ENTIRE FACE OF THE STUD; TIE WRAPS ARE NOT ACCEPTABLE.
  - F. PROVIDE INTERMEDIATE TYPE SPACERS 10'-0" ON CENTERS FOR SUPPORT AND PROTECTION OF ALL DIRECT BURIED CONDUIT.
  - G. FASTEN CONDUIT SUPPORT DEVICES TO STRUCTURE WITH WOOD SCREWS ON WOOD, TOGGLE BOLTS ON HOLLOW MASONRY, EXPANSION ANCHORS ON SOLID MASONRY OR CONCRETE, AND MACHINE BOLTS OR CLAMPS ON STEEL. NAILS ARE NOT ACCEPTABLE.
  - H. CONDUIT SHALL BE RUN PARALLEL OR AT RIGHT ANGLES TO WALLS, CEILING AND STRUCTURAL MEMBERS. SUPPORT BRANCH CIRCUIT CONDUITS AT INTERVALS NOT EXCEEDING 3 FEET AND WITHIN 3 FEET OF EACH BOX OR CHANGE OF DIRECTION. PROVIDE AN EXPANSION AND DEFLECTION COUPLING WHERE CONDUITS CROSS A BUILDING EXPANSION JOINTS.
  - I. EXPANSION FITTINGS SHALL BE PROVIDED IN ALL CONDUITS WITH A ROUTE ACROSS A BUILDING EXPANSION JOINT OR WITH A STRAIGHT RUN EXCEEDING 30'.
- 2.2 600V WIRES AND CABLES**
- A. CONDUCTORS SHALL BE ELECTRICALLY CONTINUOUS AND FREE FROM SHORT CIRCUITS OR GROUNDS. ALL OPEN, SHORTED, OR GROUNDED CONDUCTORS AND ANY WITH DAMAGED INSULATION SHALL BE REMOVED AND REPLACED AT THE CONTRACTOR'S EXPENSE WITH NEW MATERIAL FREE FROM DEFECTS.
  - B. CONDUCTOR SIZE SHALL BE MINIMUM OF NO. 12 AWG, UNLESS A LARGER SIZE IS REQUIRED BY THE DRAWINGS OR THE NEC. INSULATION VOLTAGE LEVEL RATING SHALL BE 600 VOLTS. ALL WIRE AND CABLE SHALL BEAR UL LABEL.
  - C. CONDUCTORS SHALL BE STRANDED COPPER 90 C° TYPE THWN/THHN FOR CONDUCTORS #2 AND SMALLER, OR XHHW-2 FOR CONDUCTORS #1 AND LARGER EXCEPT THAT #10 AND #12 SHALL BE SOLID. FIXTURE WIRE SHALL BE NO. 16 AWG SILICONE RUBBER INSULATED, STRANDED FIXTURE WIRE TYPE SFF-2 OR NO. 16 THERMOPLASTIC NYLON JACKETED STRANDED FIXTURE WIRE TYPE TFFN. USE CABLE TRAY RATED CABLES APPROVED FOR LOCATION IN CABLE TRAYS.
  - D. COLOR CODE ALL CONDUCTORS. NUMBER 10 AND SMALLER SHALL HAVE SOLID COLOR COMPOUND OR COATING. NUMBER 8 AND LARGER SHALL HAVE SOLID COLOR COMPOUND OR COLORED PHASE TAPE; TAPE SHALL BE INSTALLED ON CONDUCTORS IN EVERY BOX, TERMINATION POINT, CABINET OR ENCLOSURE. CODING SHALL BE AS FOLLOWS:
    1. 208Y/120 VOLT THREE PHASE, FOUR WIRE WYE SYSTEM: PHASE A-BLACK, PHASE B-RED, PHASE C-BLUE, NEUTRAL-WHITE.
    2. GROUNDING CONDUCTORS SHALL BE GREEN OR GREEN TRACED.
  - E. MAINTAIN PHASE ROTATION ESTABLISHED PER LATEST EDITION OF THE NEC AT SERVICE EQUIPMENT THROUGHOUT ENTIRE PROJECT.
  - F. GROUP AND LACE WITH NYLON TIE STRAPS ALL CONDUCTORS WITHIN ENCLOSURE. MAKE SPLICES IN CONDUCTORS ONLY WITHIN JUNCTION BOXES, WIRING TROUGHS, OR OTHER NEC APPROVED ENCLOSURES. DO NOT SPLICE CONDUCTORS IN PULL BOXES, SWITCHBOARDS, PANELBOARDS, SAFETY SWITCHES, OR MOTOR CONTROL ENCLOSURES. IDENTIFY EACH CONDUCTOR AS TO CIRCUIT CONNECTION IN ALL BOXES AND ENCLOSURES.

## 2-BASIC MATERIALS (CONTINUED)

- 2.3 BOXES**
- A. THE FOLLOWING SPECIFICATIONS AND STANDARDS ARE INCORPORATED INTO AND BECOME A PART OF THIS SPECIFICATION.
    1. UNDERWRITER'S LABORATORIES, INC. PUBLICATIONS 50, 467, 514.
  - B. BOXES SHALL BE HOT-DIPPED GALVANIZED STEEL SHEET METAL, UNLESS RUSTPROOF CAST METAL IS SPECIFIED OR REQUIRED BY THE NEC.
  - C. DIMENSIONS OF PULL AND JUNCTION BOXES SHALL NOT BE LESS THAN THOSE REQUIRED BY THE NEC FOR THE NUMBER, SIZE AND POSITION OF CONDUCTORS ENTERING THE BOX. WOOD SUPPORTS WITHIN PULL BOXES ARE NOT ACCEPTABLE. PROVIDE BOX COVERS FOR ALL BOXES.
  - D. ALL BOXES SHALL BE COMPLETELY ACCESSIBLE AND AS REQUIRED BY THE NEC. PROVIDE ACCESS PANELS IN ALL NON-ACCESSIBLE SPACES TO PERMIT ACCESS TO BOXES. PROVIDE AN OUTLET BOX FOR EACH LIGHTING FIXTURE OR AS INDICATED ON THE DRAWINGS AND FOR EACH DEVICE. BOX SIZES SHALL BE INCREASED FOR THOSE OUTLINED ABOVE IF REQUIRED BY THE NEC.
  - E. SUPPORT EVERY BOX FROM STRUCTURE. SECURE TO WOOD WITH WOOD SCREWS, HOLLOW MASONRY WITH TOGGLE BOLTS, METAL WITH SHEET METAL SCREWS, SOLID MASONRY OR CONCRETE WITH EXPANSION ANCHORS, METAL STUDS WITH SPRING STEEL CLAMPS, AND STRUCTURE WITH THREADED STEEL RODS WHEN SUSPENDED. SET OUTLET BOXES FOR FLUSH MOUNTED DEVICES TO WITHIN 1/8" OF FINISHED WALLS; SPACERS OR SHIMS BETWEEN BOX AND DEVICE ARE NOT ACCEPTABLE. SUPPORT OUTLET BOXES OF SURFACE MOUNTED INCANDESCENT LIGHTING FIXTURES BY LIGHT WEIGHT CHANNEL SPANNING BETWEEN AND MOUNTED TO MAIN CEILING SUPPORT MEMBER, ATTACHED BY GALVANIZED TIE WIRE OR NYLON TIE STRAPS.
  - F. MARK JUNCTION BOX COVERS WITH PERMANENT MARKER TO SHOW PANEL NAME AND CIRCUIT NUMBER OF CONDUCTORS INSIDE BOX.
  - G. WIRING DEVICES SHALL BE INSTALLED IN SURFACE MOUNTED CAST TYPE BOXES, CROUSE-HINDS FS OR FOR APPROVED EQUIVALENTS.
- 2.4 WIRING DEVICES**
- A. PRODUCTS OR ARROW HART DIV.; 1221 SERIES FOR SWITCHES AND 5362 SERIES FOR RECEPTACLES WHICH COMPLY WITH THESE SPECIFICATIONS ARE ACCEPTABLE.
  - B. RECEPTACLES SHALL BE BROWN DEVICES WITH STAINLESS STEEL COVER PLATES. RECEPTACLE COVER PLATES SHALL BE LABELED WITH PANEL NAME AND CIRCUIT NUMBER.
  - C. RECEPTACLES SHALL BE MOUNTED WITH GROUND POLES DOWN.
  - D. RECEPTACLES: COMPLY WITH UL STANDARD 498, "ELECTRICAL ATTACHMENT PLUGS AND RECEPTACLES", HEAVY DUTY GRADE.
  - E. GROUND-FAULT CIRCUIT INTERRUPTER (GFCI) RECEPTACLES: UL STANDARD 943, "GROUND FAULT CIRCUIT INTERRUPTERS", NON-FEED THROUGH TYPE, WITH INTEGRAL NEMA 5-20R DUPLEX RECEPTACLE.
- 2.5 SUPPORTING DEVICES**
- A. PROVIDE AND INSTALL SUPPORTING DEVICES WHICH COMPLY WITH MANUFACTURER'S STANDARD MATERIALS, DESIGN, AND CONSTRUCTION IN ACCORDANCE WITH PUBLISHED STANDARDS AS FAR AS REQUIRED FOR COMPLETE INSTALLATION.
  - B. COORDINATE WITH OTHER ELECTRICAL WORK INCLUDING RACEWAY AND WIRING WORK, AS NECESSARY TO INTERFACE INSTALLATION OF SUPPORTING DEVICES. INSTALL HANGAR SUPPORTS, CLAMPS, AND ATTACHMENTS TO SUPPORT PIPING PROPERLY FROM BUILDING STRUCTURE OR TORQUE SLEEVE SEAL NUTS, COMPLYING WITH MANUFACTURER'S RECOMMENDED VALUES. ENSURE THAT SEALING DEVICES EXPAND TO FORM WATER-TIGHT SEAL.

## 3-FIRE ALARM

- 3.1 DESCRIPTION:**
- A. THE FIRE ALARM SYSTEM SHALL COMPLY WITH REQUIREMENTS OF NFPA STANDARD NO. 72 FOR PROTECTED PREMISES SIGNALING SYSTEMS EXCEPT AS MODIFIED AND SUPPLEMENTED BY THIS SPECIFICATION. THE SYSTEM SHALL BE ELECTRICALLY SUPERVISED AND MONITOR THE INTEGRITY OF ALL CONDUCTORS. CONTRACTOR SHALL PROVIDE ALL MATERIALS, CONDUIT AND WIRING FOR A COMPLETE AND WORKING FIRE ALARM SYSTEM. FIRE ALARM SYSTEM SHALL BE DESIGNED BY QUALIFIED DESIGN SPECIALIST FOR THE MANUFACTURER OF THE FIRE ALARM SYSTEM AND THE MANUFACTURER'S REPRESENTATIVE SHALL PROVIDE DETAIL DRAWINGS INDICATING ALL PARTS, MATERIALS, PLAN DRAWINGS, RISERS AND WIRING.
- 3.2 SCOPE:**
- A. PROVIDE ALL NEW PARTS, MODULES AND ACCESSORIES AS REQUIRED. THE FINISHED SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THESE SPECIFICATIONS AND DRAWINGS AND SHALL BE COMPLETE.
- 3.3 BASIC PERFORMANCE:**
- A. ALARM, TROUBLE AND SUPERVISORY SIGNALS FROM ALL INTELLIGENT ADDRESSABLE REPORTING DEVICES SHALL BE ENCODED ONTO A CLASS A (NFPA STYLE 6, 7) SIGNALING LINE CIRCUIT (SLC).
  - B. INITIATION DEVICE CIRCUITS (IDCS) SHALL BE WIRED CLASS A (NFPA STYLE Y) OR CLASS A (NFPA STYLE Z).
  - C. NOTIFICATION APPLIANCE CIRCUITS SHALL BE WIRED CLASS B (NFPA STYLE Y) OR CLASS A (NFPA STYLE Z).
  - D. BUILT-IN HORN STROBE SYNCHRONIZATION W/ SELECTIVE SILENCE.
  - E. DIGITIZED ELECTRONIC SIGNALS SHALL EMPLOY CHECK DIGITS OR MULTIPLE POLLING.
  - F. A SINGLE GROUND OR OPEN ON THE SYSTEM SIGNALING LINE CIRCUIT (SLC) SHALL NOT CAUSE SYSTEM MALFUNCTION, LOSS OF OPERATING POWER OR THE ABILITY TO REPORT AN ALARM.
  - G. ALARM SIGNALS ARRIVING AT THE MAIN FACP SHALL NOT BE LOST FOLLOWING A POWER FAILURE (OR OUTAGE) UNTIL THE ALARM SIGNAL IS PROCESSED AND RECORDED.
- 3.4 BASIC SYSTEM FUNCTIONAL OPERATION:**
- A. WHEN A FIRE ALARM CONDITION IS DETECTED AND REPORTED BY ONE OF THE SYSTEM INITIATING DEVICES THE FOLLOWING FUNCTIONS SHALL IMMEDIATELY OCCUR:
    1. THE SYSTEM ALARM LED SHALL FLASH.
    2. A LOCAL PIEZO ELECTRIC SIGNAL IN THE CONTROL PANEL SHALL SOUND.
    3. A 80- CHARACTER, BACKLIT LCD DISPLAY OR EQUIVALENT SHALL INDICATE ALL INFORMATION ASSOCIATED WITH THE FIRE ALARM CONDITION, INCLUDING THE TYPE OF ALARM POINT AND ITS LOCATION WITHIN PROTECTED PREMISES.
    4. PRINTING AND HISTORY STORAGE EQUIPMENT SHALL LOG THE INFORMATION ASSOCIATED WITH EACH NEW FIRE ALARM CONTROL PANEL CONDITION, ALONG WITH TIME AND DATE OF OCCURRENCE.
    5. ALL SYSTEM OUTPUT PROGRAMS ASSIGNED VIA CONTROL-BY-EVENT EQUATIONS TO BE ACTIVATED BY THE PARTICULAR POINT IN ALARM SHALL BE EXECUTED, AND THE ASSOCIATED SYSTEM OUTPUTS (ALARM NOTIFICATION APPLIANCES AND/OR RELAYS) SHALL BE ACTIVATED.
- 3.5 TESTING:**
- A. TESTING SYSTEMS AND COMPONENTS SHALL BE TESTED AND DEMONSTRATED TO MEET FULL FUNCTIONAL REQUIREMENTS. SPECIFIC TESTS SHALL BE PERFORMED AS SPECIFIED, INDICATED, OR REQUIRED.

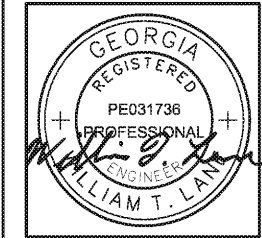


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