

ELECTRICAL SPECIFICATIONS

ELECTRICAL CONDUITS

- A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
- ALCAN PRODUCTS CORPORATION; ALCAN CABLE DIVISION; AMERICAN INSULATED WIRE CORP.; A LEVITON COMPANY; GENERAL CABLE CORPORATION;
 - SENATOR WIRE & CABLE COMPANY.
- COPPER CONDUITS: COMPLY WITH NEMA WC 70.
- CONDUCTOR INSULATION: COMPLY WITH NEMA WC 70 FOR TYPES THIN, THIN-THIN, XHHW, UL, USE, AND D.
- B. MULTICONDUCTOR CABLE: COMPLY WITH NEMA WC 70 FOR ARMORED CABLE, TYPE AC, METAL-CLAD CABLE, TYPE MC, TYPE MC-TYPE 50, AND TYPE USE WITH DRIP-PROOF WIRE.
- C. CONDUCTOR MATERIAL APPLICATIONS:
- COPPER: SOLID FOR NO. 10 AND SMALLER, STRANDED FOR NO. 8 AWG AND LARGER.
 - PVC-COATED STEEL CONDUIT: PVC-COATED RIGID STEEL CONDUIT.
 - F. STEEL CONDUIT WITH NEMA IN 1.
 - G. COATING THICKNESS: 0.040 INCH (1 MM), MINIMUM.
 - H. FITTINGS FOR CONDUIT INCLUDING ALL TYPES AND FLEXIBLE AND LIQUIDTIGHT, EMT, AND CABLE: NEMA FB 1, LISTED FOR USE AND RACEWAY WITH WHICH USED, AND FOR APPLICATION AND ENVIRONMENT IN WHICH INSTALLED.
 - I. FITTINGS FOR EMT: STEEL SET-SCREW OR COMPRESSION TYPE, DIE-CAST IS NOT ACCEPTABLE.
 - J. COATING FOR FITTINGS FOR PVC-COATED CONDUIT: MINIMUM THICKNESS, 0.040 INCH (1 MM), WITH OVERLAPPING SLEEVES PROTECTING THREADED JOINTS.
 - K. JOINT COMPOUND FOR RIGID STEEL CONDUIT OR MC: LISTED FOR USE IN CABLE CONNECTOR ASSEMBLIES, AND COMPOUNDED FOR USE TO LUBRICATE AND PROTECT THREADED RACEWAY JOINTS FROM CORROSION AND ENHANCE THEIR CONDUCTIVITY.
 - L. SURFACE METAL FINISH: GALVANIZED STEEL WITH SHAP-ON COVERS. MANUFACTURER'S STANDARD ENAMEL FINISH IN COLOR SELECTED BY ARCHITECT.
 - M. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
 - 1. THOMAS & BETTS CORPORATION
 - 2. WALKER SYSTEMS, INC.; WIREMOLD COMPANY (THEY)
 - 3. WIREMOLD COMPANY (THEY); ELECTRICAL SALES DIVISION.
 - N. BOXES, ENCLOSURES, AND CABINETS:
 - 1. COOPER CROSSE-INCHS, DIV. OF COOPER INDUSTRIES, INC.
 - 2. EG/APLICON ELECTRIC.
 - 3. HOFFMAN.
 - 4. HUBBELL INCORPORATED; KILLAR ELECTRIC MANUFACTURING CO. DIVISION.
 - 5. O-2/GENEY; A UNIT OF GENERAL SIGNAL.
 - 6. RACO; A HUBBELL COMPANY.
 - 7. ROBERT INDUSTRIES; ENCLOSURE DIVISION.
 - 8. THOMAS & BETTS CORPORATION.
 - 9. WALKER SYSTEMS, INC.; WIREMOLD COMPANY (THEY).
 - 10. SHEET METAL OUTLET AND DEVICE BOXES: NEMA OS 1.
 - P. CAST-METAL OUTLET AND DEVICE BOXES: NEMA FB 1, FERROUS ALLOY, TYPE FDI, WITH CASTED COVERS.
 - Q. METAL FLOOR BOXES: CAST METAL, FULLY ADJUSTABLE, RECTANGULAR.
 - R. WALKER SYSTEMS, INC.; WIREMOLD COMPANY (THEY).
 - S. CAST-METAL ACCESS, PULL, AND JUNCTION BOXES: NEMA FB 1, GALVANIZED, CAST IRON WITH GASKETED COVER.
 - T. SURFACE METAL ENCLOSURES: NEMA 250, TYPE 1, WITH CONTINUOUS-HINGE COVER WITH FLUSH LATCH, UNLESS OTHERWISE INDICATED.

GROUNDING

- A. INSULATED CONDUCTORS: COPPER WIRE OR CABLE INSULATED FOR 600 V UNLESS OTHERWISE REQUIRED BY APPLICABLE CODE OR AUTHORITIES HAVING JURISDICTION.
- B. BARE COPPER CONDUCTORS:
 - SOLID CONDUCTORS: ASTM B 3.
 - STRANDED CONDUCTORS: ASTM B 8.
 - BONDING CABLE: 28 XCMIL, 14 STRANDS OF NO. 17 AWG CONDUCTOR, 1/4 INCH (6 MM) DIAMETER.
- C. STRANDED CONDUCTOR: NO. 4 OR NO. 6 AWG, STRANDED CONDUCTOR.
- D. BONDING JAMPER: COPPER TAPE, BROAD CONDUCTORS TERMINATED WITH COPPER FERULES; 1-5/8 INCHES (41 MM) WIDE AND 1/16 INCH (1.6 MM) THICK.
- C. GROUNDING BUS: PREDRILLED RECTANGULAR BARS OF ANNEALED COPPER, 1/4 BY 4 INCHES (6.3 BY 100 MM) IN CROSS SECTION, WITH 9/32-INCH (7.14-MM) HOLES SPACED 1-1/8 INCHES (28 MM) APART. STAND-OFF INSULATORS FOR MOUNTING SHALL COMPLY WITH UL 891 FOR USE IN SWITCHBOARDS, 600 V. LEXAN, IMPULSION TESTED AT 5000 V.
- D. CONDUCTORS LISTED AND LABELED BY AN NRTL, ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION FOR APPLICATIONS IN WHICH USED, AND FOR SPECIFIC TYPES, SIZES, AND COMBINATIONS OF CONDUCTORS AND OTHER ITEMS CONNECTED.
- E. BOLTED CONNECTORS FOR CONDUCTORS AND PIPES: COPPER OR COPPER ALLOY, PRESSURE TIGHT WITH AT LEAST TWO BOLTS.
- F. WELDED CONNECTORS: EXOTHERMIC-WELDING KITS OF TYPES RECOMMENDED BY KIT MANUFACTURER FOR MATERIALS BEING JOINED AND INSTALLATION CONDITIONS.
- G. BUS-BAR CONNECTORS: MECHANICAL TYPE, CAST SILICON BRONZE, SOLDERLESS COMPRESSION-TYPE WIRE TERMINALS, AND LONG-BARREL, TWO-BOLT CONNECTION TO GROUND BUS BAR.
- H. CONDUCTORS: INSTALL SOLID CONDUCTOR FOR NO. 8 AWG AND SMALLER, AND STRANDED CONDUCTORS FOR NO. 6 AWG AND LARGER UNLESS OTHERWISE INDICATED.
- I. ISOLATED GROUNDING CONDUCTORS: GREEN-COLORED INSULATION WITH CONTINUOUS YELLOW STRIPE. FEEDERS WITH ISOLATED GROUND IDENTIFY GROUNDING CONDUCTOR WHERE VISIBLE TO NORMAL INSPECTION, WITH ALTERNATING BANDS OF GREEN AND YELLOW TAPE, WITH AT LEAST THREE BANDS OF GREEN AND TWO BANDS OF YELLOW.
- J. CONDUCTOR TERMINATIONS AND CONNECTIONS:
- PIPE AND EQUIPMENT GROUNDING CONDUCTOR TERMINATIONS: BOLTED CONNECTORS.
 - UNDERGROUND CONNECTIONS: WELDED CONNECTORS EXCEPT AT TEST WELLS AND AS OTHERWISE INDICATED. CONNECTIONS TO GROUND RODS AT TEST WELLS SHALL BE WELDED CONNECTORS. CONNECTIONS TO STRUCTURAL STEEL: WELDED CONNECTORS.
- K. EQUIPMENT GROUNDING:
 - INSTALL INSULATED EQUIPMENT GROUNDING CONDUCTORS TO COMPLY WITH THE NEC AND AS INDICATED ON THE DRAWINGS.

ELECTRICAL HANGERS AND SUPPORTS

- A. COMPLY WITH NECA 1 AND NECA 101 FOR APPLICATION OF HANGERS AND SUPPORTS FOR ELECTRICAL EQUIPMENT AND SYSTEMS EXCEPT IF REQUIREMENTS IN THIS SECTION ARE STRICTER. MAXIMUM SUPPORT SPACING AND MINIMUM HANGER ROD SIZE FOR RACEWAYS:
- SPACE SUPPORTS FOR EMT, IMC, AND RMC AS SCHEDULED IN NECA 1, WHERE ITS TABLE 1 LISTS MAXIMUM SPACINGS LESS THAN STATED IN NFPA 70. MINIMUM ROD SIZE SHALL BE 1/4 INCH (6 MM) IN DIAMETER. MULTIPLE RACEWAYS OR CABLES: INSTALL TRAPEZOIDAL TYPE SUPPORTS FABRICATED WITH STEEL SLOTTED OR OTHER SUPPORT SYSTEM, SIZED SO CAPACITY CAN BE INCREASED BY AT LEAST 25 PERCENT IN FUTURE WITHOUT EXCEEDING SPECIFIED DESIGN LOAD LIMITS. SECURE RACEWAYS AND CABLES TO THESE SUPPORTS WITH TWO-BOLT CONDUIT CLAMPS, SPRING-STEEL CLAMPS DESIGNED FOR SUPPORTING SINGLE CONDUITS WITHOUT BOLTS MAY BE USED FOR 1-1/2-INCH (38-MM) AND SMALLER RACEWAYS SERVING BRANCH CIRCUITS AND COMMUNICATION SYSTEMS ABOVE SUSPENDED CEILINGS AND FOR FASTENING RACEWAYS TO TRAPEZOIDAL SUPPORTS.
- B. SUPPORT INSTALLATION: COMPLY WITH NECA 1 AND NECA 101 FOR INSTALLATION REQUIREMENTS EXCEPT AS SPECIFIED IN THIS ARTICLE.
- C. RACEWAY SUPPORT METHODS: IN ADDITION TO METHODS DESCRIBED IN NECA 1, EMT, IMC, AND RMC MAY BE SUPPORTED BY OPENINGS THROUGH STRUCTURE MEMBERS, AS PERMITTED IN NFPA 70.
- D. STRENGTH OF SUPPORT ASSEMBLIES: WHERE NOT INDICATED, SELECT SIZES OF COMPONENTS SO STRENGTH WILL BE ADEQUATE TO CARRY PRESENT AND FUTURE STATIC LOADS WITH SPECIFIED LOADING LIMITS. MINIMUM STATIC DESIGN LOAD USED FOR STRENGTH DETERMINATION SHALL BE WEIGHT OF SUPPORTED COMPONENTS PLUS 200 LB (90 KG).
- E. MOUNTING AND ANCHORAGE OF SURFACE-MOUNTED EQUIPMENT AND COMPONENTS: ANCHOR AND FASTEN ELECTRICALS AND THEIR SUPPORTS TO BUILDING STRUCTURAL ELEMENTS BY THE FOLLOWING METHODS UNLESS OTHERWISE INDICATED BY CODE:
 - TO WOOD: FASTEN WITH LAG SCREWS OR THROUGH BOLTS.
 - TO NEW CONCRETE: USE ANCHOR FASTENERS.
 - TO MASONRY: APPROVED TONGUE-TYPE BOLTS ON HOLLOW MASONRY UNITS AND EXPANSION ANCHOR FASTENERS ON SOLID MASONRY UNITS.
 - TO EXISTING CONCRETE: EXPANSION ANCHOR FASTENERS.
 - INSTEAD OF EXPANSION ANCHORS, POWER-ACTUATED DRIVEN THREADED STUDS PROVIDED WITH LOCK WASHERS AND NUTS MAY BE USED IN EXISTING STANDARD-WEIGHT CONCRETE 4 INCHES (100 MM) THICK OR GREATER. DO NOT USE FOR ANCHORAGE TO LIGHTWEIGHT-AGGREGATE CONCRETE OR FOR SLABS LESS THAN 4 INCHES (100 MM) THICK.
 - TO STEEL: WELDED THREADED STUDS COMPLYING WITH AWS D11/D11.M, WITH LOCK WASHERS AND NUTS OR BEAM CLAMPS (MSS TYPE 18, 21, 23, 25, OR 27) COMPLYING WITH MSS SP-89.
 - TO LIGHT STEEL: SPLIT METAL SCREWS.
 - DRILL HOLES FOR EXPANSION ANCHORS IN CONCRETE AT LOCATIONS AND TO DEPTHS THAT AVOID REINFORCING BARS.

ELECTRICAL CONDUIT

- A. METAL CONDUIT AND TUBING MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
- AFC CABLE SYSTEMS, INC.
 - ALFLEX INC.
 - ALLOY TUBE & CONDUIT; A TYCO INTERNATIONAL LTD. CO.
 - ANAMEI ELECTRICAL, INC.; ANACONDA METAL HOSE.
 - CONDUIT-FLEX CO.
 - MAVERICK TUBE CORPORATION.
 - O-2/GENEY; A UNIT OF GENERAL SIGNAL.
 - WATLAND TUBE COMPANY.
 - RIGID STEEL CONDUIT: ANSIC 801.
 - ALUMINUM RIGID CONDUIT: ANSIC 802S.
 - MC; ANSIC 806.
 - PVC-COATED STEEL CONDUIT: PVC-COATED RIGID STEEL CONDUIT.
 - F. STEEL CONDUIT WITH NEMA IN 1.
 - G. COATING THICKNESS: 0.040 INCH (1 MM), MINIMUM.
 - H. FITTINGS FOR CONDUIT INCLUDING ALL TYPES AND FLEXIBLE AND LIQUIDTIGHT, EMT, AND CABLE: NEMA FB 1, LISTED FOR USE AND RACEWAY WITH WHICH USED, AND FOR APPLICATION AND ENVIRONMENT IN WHICH INSTALLED.
 - I. FITTINGS FOR EMT: STEEL SET-SCREW OR COMPRESSION TYPE, DIE-CAST IS NOT ACCEPTABLE.
 - J. COATING FOR FITTINGS FOR PVC-COATED CONDUIT: MINIMUM THICKNESS, 0.040 INCH (1 MM), WITH OVERLAPPING SLEEVES PROTECTING THREADED JOINTS.
 - K. JOINT COMPOUND FOR RIGID STEEL CONDUIT OR MC: LISTED FOR USE IN CABLE CONNECTOR ASSEMBLIES, AND COMPOUNDED FOR USE TO LUBRICATE AND PROTECT THREADED RACEWAY JOINTS FROM CORROSION AND ENHANCE THEIR CONDUCTIVITY.
 - L. SURFACE METAL FINISH: GALVANIZED STEEL WITH SHAP-ON COVERS. MANUFACTURER'S STANDARD ENAMEL FINISH IN COLOR SELECTED BY ARCHITECT.
 - M. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
 - 1. THOMAS & BETTS CORPORATION
 - 2. WALKER SYSTEMS, INC.; WIREMOLD COMPANY (THEY)
 - 3. WIREMOLD COMPANY (THEY); ELECTRICAL SALES DIVISION.
 - N. BOXES, ENCLOSURES, AND CABINETS:
 - 1. COOPER CROSSE-INCHS, DIV. OF COOPER INDUSTRIES, INC.
 - 2. EG/APLICON ELECTRIC.
 - 3. HOFFMAN.
 - 4. HUBBELL INCORPORATED; KILLAR ELECTRIC MANUFACTURING CO. DIVISION.
 - 5. O-2/GENEY; A UNIT OF GENERAL SIGNAL.
 - 6. RACO; A HUBBELL COMPANY.
 - 7. ROBERT INDUSTRIES; ENCLOSURE DIVISION.
 - 8. THOMAS & BETTS CORPORATION.
 - 9. WALKER SYSTEMS, INC.; WIREMOLD COMPANY (THEY).
 - 10. SHEET METAL OUTLET AND DEVICE BOXES: NEMA OS 1.
 - P. CAST-METAL OUTLET AND DEVICE BOXES: NEMA FB 1, FERROUS ALLOY, TYPE FDI, WITH CASTED COVERS.
 - Q. METAL FLOOR BOXES: CAST METAL, FULLY ADJUSTABLE, RECTANGULAR.
 - R. WALKER SYSTEMS, INC.; WIREMOLD COMPANY (THEY).
 - S. CAST-METAL ACCESS, PULL, AND JUNCTION BOXES: NEMA FB 1, GALVANIZED, CAST IRON WITH GASKETED COVER.
 - T. SURFACE METAL ENCLOSURES: NEMA 250, TYPE 1, WITH CONTINUOUS-HINGE COVER WITH FLUSH LATCH, UNLESS OTHERWISE INDICATED.
 - U. METAL ENCLOSURES: STEEL, FINISHED INSIDE AND OUT WITH MANUFACTURER'S STANDARD ENAMEL.
 - A. IN STANDARD PARTITIONS, WHERE 1/2" AND 3/4" CONDUITS ARE EMPLOYED: 4" SQUARE BY 1-1/2" DEEP BODIES WITH 1-GANG OR 2-GANG PLASTER COVERS SHALL BE USED, NO. 45-SPL.
 - B. IN THIN PARTITIONS MEASURING 1-1/2" OR LESS, 4" SQUARE BY 1-1/2" DEEP BODIES WITH 1-GANG OR 2-GANG PLASTER COVERS SHALL BE USED, NO. 45-SPL.
 - C. IN STANDARD PARTITIONS, WHERE CONDUITS OF A SIZE GREATER THAN 3/4" ARE EMPLOYED: 4" SQUARE BY 2-1/8" DEEP BODIES WITH 1-GANG OR 2-GANG PLASTER COVERS SHALL BE USED, NO. 45D SERIES. THE OUTLET BOXES SHALL BE LOCATED WHEREBY NO TWO (2) OUTLET BOXES ARE INSTALLED CLOSER THAN 24" ON CENTER, AND SECURELY ATTACHED TO THE PARTITION STUDS, WITH AT LEAST ONE (1) PARTITION STUD SEPARATING THE OUTLET BOXES. IT IS NOT ACCEPTABLE TO DRYWALL PARTITION.

TRANSFORMERS

- A. SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
- ADAM ELECTRIC CORPORATION; POWER DISTRIBUTION PRODUCTS DIVISION.
 - EATON ELECTRICAL INC.; CUTLER-HAMMER PRODUCTS.
 - GENERAL ELECTRIC COMPANY.
 - GENCO ENERGY & AUTOMATION, INC.
 - SOLA/NEV-DUTY.
 - SQUARE D; SCHNEIDER ELECTRIC.
- B. GENERAL TRANSFORMER REQUIREMENTS:
- DESCRIPTION: FACTORY-ASSEMBLED AND -TESTED, AIR-COOLED UNITS FOR 60-HZ SERVICE. GRAIN-ORIENTED, NON-AGING SILICON STEEL.
 - CONTINUOUS WINDINGS WITHOUT SLEEVES EXCEPT FOR TAPS.
 - INTERNAL COIL CONNECTIONS: BRAZED OR PRESSURE TIE.
 - CIL MATERIAL: COPPER.
- C. COMPLY WITH NEMA ST 2, AND LIST AND LABEL AS COMPLYING WITH UL 1561, ONE LED PER PHASE.
- D. ENCLOSURE: VENTILATED, NEMA 250, TYPE 2, CORE AND COIL SHALL BE ENCAPSULATED WITHIN RESIN COMPOUND, SEALING OUT MOISTURE AND AIR.
- E. ENCLOSURE: VENTILATED, NEMA 250, TYPE 3R, CORE AND COIL SHALL BE ENCAPSULATED WITHIN RESIN COMPOUND, SEALING OUT MOISTURE AND AIR.
- F. TRANSFORMER ENCLOSURE FINISH: COMPLY WITH NEMA 250, FINISH COLOR: GRAY.
- G. TAPS FOR TRANSFORMERS SMALLER THAN 7.5 KVA: ONE 5 PERCENT TAP ABOVE NORMAL FULL CAPACITY.
- H. TAPS FOR TRANSFORMERS 7.5 TO 24 KVA: ONE 5 PERCENT TAP ABOVE AND ONE 5 PERCENT TAP BELOW NORMAL FULL CAPACITY.
- I. TAPS FOR TRANSFORMERS 25 KVA AND LARGER: TWO 2.5 PERCENT TAPS ABOVE AND TWO 2.5 PERCENT TAPS BELOW NORMAL FULL CAPACITY.
- J. INSULATION CLASS: 220 DEG C, UL-COMPARTMENT-TEMPERATED INSULATION SYSTEM WITH A MAXIMUM OF 115 DEG C RISE ABOVE 40 DEG C AMBIENT TEMPERATURE.
- K. ENERGY EFFICIENCY FOR TRANSFORMERS RATED 15 KVA AND LARGER: COMPLYING WITH DOE-2016 10 CFR PART 431.
- L. K-FACTOR RATING: TRANSFORMERS INSTALLED TO BE K-FACTOR RATED SHALL COMPLY WITH UL 1561 REQUIREMENTS FOR NONSOLID-STATE LOAD-CARRYING CAPABILITY TO THE DEGREE DEFINED BY RESISTOR K-FACTOR TEST UNIT SHALL NOT EXCEED 100% OVERHEAT RATING. OVERHEAT TEST WITH HARMONIC DISTORTION CORRESPONDING TO DESIGNATED K-FACTOR INDICATE VALUE OF K-FACTOR ON TRANSFORMER NAMEPLATE.
- M. ELECTROSTATIC SHIELDING: EACH WINDING SHALL HAVE AN INDEPENDENT, SINGLE LAYER OF COPPER OR ALUMINUM SHEATH, ENOUGH THICKNESS TO MINIMIZE INTERFERENCE. ARRANGE COIL LEADS AND TERMINAL STRIPS TO MINIMIZE CAPACITIVE COUPLING BETWEEN INPUT AND OUTPUT TERMINALS. INCLUDE SPECIAL TERMINAL FOR GROUNDING THE SHIELD EFFECTIVENESS CAPACITANCE BETWEEN PRIMARY AND SECONDARY WINDINGS: NOT TO EXCEED 13 PICOFARADS OVER A FREQUENCY RANGE OF 500 HZ TO 100 KHZ. MINIMUM OF 100 PICOFARADS AT 100 KHZ. MINIMUM OF 100 PICOFARADS AT 1.5 KHZ. MINIMUM OF 100 PICOFARADS AT 1.5 TO 100 KHZ. MINIMUM-WIDE NOISE ATTENUATION: MINIMUM OF 50 DB AT 15 TO 100 KHZ.
- N. FUNGUS PROOFING: PERMANENT FUNGICIDAL TREATMENT FOR COIL AND CORE.
- O. ULG RATINGS: ALL ULG CONNECTIONS SHALL BE RATED FOR CONNECTION OF 75 DEG C INSULATION CONDUCTORS.

PANELBOARDS

- A. ENCLOSURES: FLUSH- AND SURFACE-MOUNTED CABINETS, RATED FOR ENVIRONMENTAL CONDITIONS AT INSTALLED LOCATION. INDOOR DRY AND CLEAN LOCATIONS: NEMA 250, TYPE 1. OUTDOOR LOCATIONS: NEMA 250, TYPE 3R, WET OR DAMP INDOOR LOCATIONS: NEMA 250, TYPE 4X STAINLESS STEEL.
- B. FRONT: SECURED TO LOCK WITH CONCEALED TRIM CLAMPS. FOR SURFACE-MOUNTED FRONTS, MATCH BOX DIMENSIONS TO CUT PER SCHEDULED FRONT.
- C. HINGED FRONT COVER: ENTIRE FRONT TRIM HINGED TO BOX AND WITH STANDARD DOOR WITHIN HINGED TRIM DOOR.
- D. FINISHES: PANELS AND TRIM: GALVANIZED STEEL, FACTORY FINISHED IMMEDIATELY AFTER CLEANING AND PRETREATING TO MANUFACTURER'S STANDARD TWO-COAT, BASED-ON FINISH CONSISTING OF PRIME COAT AND THERMOSETTING TOPCOAT.
- E. BACK BOXES: GALVANIZED STEEL.
- F. FUNGUS PROOFING: PERMANENT FUNGICIDAL TREATMENT FOR OVERCURRENT PROTECTIVE DEVICES AND OTHER COMPONENTS.
- G. DIRECTORY CARD: INSIDE PANELBOARD DOOR, MOUNTED IN TRANSPARENT CARD HOLDER.
- H. INCHING MAINS LOCATION: TOP AND BOTTOM.
- I. PHASE, NEUTRAL AND GROUND BUSES: MATERIAL: 18-PLATED ALUMINUM OR HARD-DRAWN COPPER, 98 PERCENT CONDUCTIVITY. EQUIPMENT GROUND BUS: ADEQUATE FOR FEEDER AND BRANCH-CIRCUIT EQUIPMENT GROUNDING CONDUCTORS; BONDING TO BOX.
- J. CONDUCTOR CONNECTIONS: SUITABLE FOR USE WITH CONDUCTOR MATERIAL AND SIZES. RISER-TYPE, OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY, EMT, 98 PERCENT CONDUCTIVITY. MAIN AND NEUTRAL LUGS: COMPRESSION TYPE, GROUND LUGS AND BUS-CONFIGURED STRONG-TIGHT COMPRESSION TYPE, FEED-THROUGH LUGS: COMPRESSION TYPE, SUITABLE FOR USE WITH CONDUCTOR MATERIAL. LOCATE AT OPPOSITE END OF BUS FROM INCOMING LUGS OR MAIN DEVICE, RATED FOR CONNECTION OF 75 DEG C INSULATED CONDUCTORS.
- K. PANELBOARD SHORT-CIRCUIT CURRENT RATING: FULLY RATED TO INTERRUPT SYMMETRICAL STAINLESS STEEL IN DAMP OR WET LOCATIONS.
- L. LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS:
- 1. LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS: NEMA PB 1, LIGHTING AND APPLIANCE BRANCH-CIRCUIT TYPE.
 - 2. MAINS: CIRCUIT BREAKER OR LUGS ONLY.
 - 3. BRANCH OVERCURRENT PROTECTIVE DEVICES: BOLT-ON CIRCUIT BREAKERS, REPLACEABLE WITHOUT DISTURBING ADJACENT UNITS.
 - 4. DOORS: CONCEALED HINGES; SECURED WITH FLUSH LATCH WITH TUMBLER LOCK KEVED ULK1.

LIGHTING FIXTURES

- A. GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS:
- RECESSED FIXTURES: COMPLY WITH NEMA LE 4 FOR CEILING COMPATIBILITY FOR RECESSED FIXTURES.
 - INCANDESCENT FIXTURES: COMPLY WITH UL 1598, WHERE LER IS SPECIFIED, TEST ACCORDING TO NEMA LE 5A.
 - FLOURESCENT FIXTURES: COMPLY WITH UL 1598, WHERE LER IS SPECIFIED, TEST ACCORDING TO NEMA LE 5 AND NEMA LE 5A AS APPLICABLE.
 - LED FIXTURES:
 - 4.1. LISTED AND LABELED AS DEFINED IN NFPA 70, BY A QUALIFIED TESTING AGENCY, AND MARKED FOR INTENDED LOCATION AND APPLICATION.
 - 4.2. EACH LUMINAIRE TYPE SHALL BE BINNED WITHIN A THREE-STEP MACHADAM ELLIPSE TO ENSURE COLOR CONSISTENCY AMONG LUMINAIRES.
- METAL PARTS: FREE OF BURRS AND SHARP CORNERS AND EDGES. SHAD MAT MATERIAL COMPONENTS: STEEL UNLESS OTHERWISE INDICATED. FORM AND SUPPORT TO PREVENT WARPING AND SAGGING. DOORS, FRAMES, AND OTHER INTERNAL ACCESS: SMOOTH FINISHES. LABELS SHALL BE LOCATED WHERE THEY WILL BE READILY VISIBLE TO SERVICE PERSONNEL, BUT NOT SEEN FROM NORMAL VIEWING ANGLES WHEN LAMPS ARE IN PLACE. LABELS SHALL INCLUDE THE FOLLOWING INFORMATION AND BALLAST CHARACTERISTICS:
- USE ONLY AND INCLUDE SPECIFIC LAMP TYPE.
 - LAMP DIAMETER CODE (T-4, T-5, T-8, T-12, ETC.), TUBE CONFIGURATION (TWIN, QUAD, TRIPLE, ETC.), BASE TYPE (MR16, MR11, ETC.) FOR HID LUMINAIRES.
 - LAMP TYPE, WATTAGE, BALL TUBE (ED17, B056, ETC.) AND COATING (CLEAR OR COATED) FOR HID LUMINAIRES.
 - START TYPE (PREHEAT, RAPID START, INSTANT START, ETC.) FOR FLUORESCENT AND COMPACT FLUORESCENT LUMINAIRES.
 - AND BALLAST TYPE (MR6, MR7, ETC.) FOR HID LUMINAIRES.
 - CCT AND DR FOR ALL LUMINAIRES.
- D. ELECTROMAGNETIC INTERFERENCE AS REQUIRED BY MIL-STD-461E. FABRICATE LIGHTING FIXTURES WITH ONE FILTER ON EACH BALLAST INDICATED TO REQUIRE A FILTER.

BALLASTS

- A. BALLASTS FOR LINEAR FLUORESCENT LAMPS, GENERAL REQUIREMENTS FOR ELECTRONIC BALLASTS:
- COMPLY WITH UL 935 AND WITH ANSI C82.11.
 - DESIGNED FOR TYPE AND QUANTITY OF LAMPS SERVED.
 - BALLASTS SHALL BE DESIGNED FOR FULL LIGHT OUTPUT UNLESS ANOTHER BF, DIMMER, OR 0-LEVEL CONTROL IS INDICATED.
 - SOUND RATING: CLASS A.
 - TOTAL HARMONIC DISTORTION RATING: LESS THAN 10 PERCENT.
 - TRANSIENT VOLTAGE PROTECTION: IEEE C62.41.1 AND IEEE C62.41.2, CATEGORY A OR BETTER.
 - OPERATING FREQUENCY: 42 KHZ OR HIGHER.
 - LAMP CURRENT CREST FACTOR: 1.7 OR LESS.
 - BF: 0.80 OR HIGHER.
 - 10PERFACER FACTOR: 0.95 OR HIGHER.
 - 11.PARALLEL LAMP CIRCUITS: MULTIPLE LAMP BALLASTS SHALL COMPLY WITH ANSI C82.11 AND SHALL BE CONNECTED TO MAINTAIN FULL LIGHT OUTPUT ON SURVIVING LAMPS IF ONE OR MORE LAMPS FAIL.
- B. LUMINAIRES CONTROLLED BY OCCUPANCY SENSORS SHALL HAVE PROGRAMMED-START BALLASTS.
- C. ELECTRONIC PROGRAMMED-START BALLASTS FOR T8 AND T5 AND T5HO LAMPS: COMPLY WITH ANSI C82.11 AND THE FOLLOWING:
 - LAMP END-OF-LIFE DETECTION AND SHUTDOWN CIRCUIT FOR T5 DIAMETER LAMPS.
 - AUTOMATIC LAMP STARTING AFTER LAMP REPLACEMENT.
- D. ELECTROMAGNETIC BALLASTS: COMPLY WITH ANSI C82.1, ENERGY SAVING, HIGH-POWER FACTOR, CLASS P, AND HAVING AUTOMATIC-RESET THERMAL PROTECTION.
- E. BALLAST MANUFACTURER CERTIFICATION: INDICATED BY LABEL.
- F. SINGLE BALLASTS FOR MULTIPLE LIGHTING FIXTURES: FACTORY WIRE WITH BALLAST ARRANGEMENTS AND BUNDLED EXTENSION WIRING TO SUIT FINAL INSTALLATION CONDITIONS WITHOUT MODIFICATION OR REWIRING IN THE FIELD.
- G. BALLASTS FOR COMPACT FLUORESCENT LAMP:
- 1. ELECTRONIC PROGRAMMED-START 8W-20 W TYPE, COMPLYING WITH UL 935 AND WITH ANSI C 82.11, DESIGNED FOR TYPE AND QUANTITY OF LAMPS INDICATED. BALLAST SHALL BE DESIGNED FOR FULL LIGHT OUTPUT UNLESS OTHERWISE INDICATED.
 - 1. LAMP END-OF-LIFE DETECTION AND SHUTDOWN CIRCUIT.
 - AUTOMATIC LAMP STARTING AFTER LAMP REPLACEMENT.
 - SOUND RATING: CLASS A.
 - TOTAL HARMONIC DISTORTION RATING: LESS THAN 10 PERCENT.
 - TRANSIENT VOLTAGE PROTECTION: IEEE C62.41.1 AND IEEE C62.41.2, CATEGORY A OR BETTER.
 - OPERATING FREQUENCY: 20 KHZ OR HIGHER.
 - LAMP CURRENT CREST FACTOR: 1.7 OR LESS.
 - BF: 0.95 OR HIGHER UNLESS OTHERWISE INDICATED.
 - POWER FACTOR: 0.9 OR HIGHER.
 - 10PERFACER: COMPLY WITH 47 CFR 18, CH. 1, SUBPART C, FOR LIMITATIONS ON ELECTROMAGNETIC AND RADIO-FREQUENCY INTERFERENCE FOR NONCOMMERCIAL EQUIPMENT.

FLUORESCENT LAMPS

- A. T8 RAPID-START LAMPS, RATED 35 W MAXIMUM, NOMINAL LENGTH OF 48 INCHES (1220 MM), 2800 INITIAL LUMENS (MINIMUM), CR 85 (MINIMUM), COLOR TEMPERATURE 3000 K, AND AVERAGE RATED LIFE 20,000 HOURS UNLESS OTHERWISE INDICATED.
- B. T8 RAPID-START LAMP, V-RATED 17 W MAXIMUM, NOMINAL LENGTH OF 24 INCHES (610 MM), 1300 INITIAL LUMENS (MINIMUM), CR 85 (MINIMUM), COLOR TEMPERATURE 3000 K, AND AVERAGE RATED LIFE OF 20,000 HOURS UNLESS OTHERWISE INDICATED.
- C. T8 RAPID-START LAMPS, RATED 28 W MAXIMUM, NOMINAL LENGTH OF 45.2 INCHES (1150 MM), 5000 INITIAL LUMENS (MINIMUM), CR 85 (MINIMUM), COLOR TEMPERATURE 4000 K, AND AVERAGE RATED LIFE OF 20,000 HOURS UNLESS OTHERWISE INDICATED.
- D. T8 RAPID-START LAMPS, RATED 28 W MAXIMUM, NOMINAL LENGTH OF 45.2 INCHES (1150 MM), 5000 INITIAL LUMENS (MINIMUM), CR 85 (MINIMUM), COLOR TEMPERATURE 4000 K, AND AVERAGE RATED LIFE OF 20,000 HOURS UNLESS OTHERWISE INDICATED.
- E. COMPACT FLUORESCENT LAMPS:
 - 1. 1.3 W, 14, DOUBLE OR TRIPLE TUBE, RATED 900 INITIAL LUMENS (MINIMUM).
 - 2. 1.8 W, 14, DOUBLE OR TRIPLE TUBE, RATED 1200 INITIAL LUMENS (MINIMUM).
 - 3. 2.6 W, 14, DOUBLE OR TRIPLE TUBE, RATED 1400 INITIAL LUMENS (MINIMUM).
 - 4. 3.2 W, 14, TRIPLE TUBE, RATED 2400 INITIAL LUMENS (MINIMUM).
 - 5. 4.2 W, 14, TRIPLE TUBE, RATED 3200 INITIAL LUMENS (MINIMUM).
 - 6. 5.7 W, 14, TRIPLE TUBE, RATED 4200 INITIAL LUMENS (MINIMUM).
 - 7. 7.0 W, 14, TRIPLE TUBE, RATED 5000 INITIAL LUMENS (MINIMUM).

LED LAMPS

- A. MINIMUM LUMENS PER SCHEDULED FIXTURE.
- B. MINIMUM ALLOWABLE EFFICACY OF 85 LM/W.
- C. MATCH BOX DIMENSIONS TO CUT PER SCHEDULED FIXTURE.
- D. RATED LAMP LIFE OF 50,000 HOURS TO L70.
- E. DIMMABLE FROM 100 PERCENT TO 10 PERCENT OF MAXIMUM LIGHT OUTPUT.
- F. USER-REPLACEABLE LAMPS:
 - 1. BUILD SHARP COMPLYING WITH ANSI C78.79.
 - 2. LAMP BASE COMPLYING WITH ANSI C81.81 OR IEC 60061-1.

WIRING DEVICES

- A. MANUFACTURERS:
 - 1. COOPER WIRING DEVICES.
 - 2. HUBBELL INCORPORATED; WIRING DEVICE-KILLMANS.
 - 3. LEVITON MFG. COMPANY INC.
 - 4. PASS & SEYMOUR/LEGRAND; WIRING DEVICES & ACCESSORIES.
- B. ALL WIRING DEVICES TO BE WHITE OR COLOR AS SELECTED BY ARCHITECT.
- C. STRAIGHT BLADE RECEPTABLES:
 - 1. CONVENIENCE RECEPTABLES, 125 V, 20 A: COMPLY WITH NEMA WD 1, NEMA WD 6 CONFIGURATION 5-20R, AND UL 498, PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
 - 1. LEVITON: 7899-W (SINGLE POLE), 5622-2 (THREE WAY)
 - 2. ANY EQUAL BY ABOVE LISTED MANUFACTURERS.
 - 2. ANY EQUAL BY ABOVE LISTED MANUFACTURERS.
- D. ISOLATED-GROUND, DUPLEX CONVENIENCE RECEPTABLES, 125 V, 20 A: COMPLY WITH NEMA WD 1, NEMA WD 6 CONFIGURATION 5-20R, AND UL 498, PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
 - 1. LEVITON: 16342-NOW.
 - 2. ANY EQUAL BY ABOVE LISTED MANUFACTURERS.
- E. GFCI RECEPTABLES:
 - GENERAL DESCRIPTION: STRAIGHT BLADE, FEED-THROUGH TYPE, COMPLY WITH NEMA WD 1, NEMA WD 6, UL 498, AND UL 943, CLASS A, AND INCLUDE INDICATOR LIGHT THAT IS LIGHTED WHEN DEVICE IS TRIPPED. DUPLEX GFCI CONVENIENCE RECEPTABLES, 125 V, 20 A: PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
 - 1. LEVITON: 7899-W.
 - 2. ANY EQUAL BY ABOVE LISTED MANUFACTURERS.
- F. SNAP SWITCHES, COMPLY WITH NEMA WD 1 AND UL 20. SWITCHES, 120/277 V, 20 A: PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
 - 1. LEVITON: 5621-2N (SINGLE POLE), 5622-2 (TWO POLES), 5623-2 (THREE WAY)
 - 2. ANY EQUAL BY ABOVE LISTED MANUFACTURERS.

FIRE PROTECTION

FIRE ALARM

- A. DO NOT INTERRUPT FIRE-ALARM SERVICE TO FACILITIES OCCUPIED BY OWNER OR OTHERS UNLESS PERMITTED UNDER THE FOLLOWING CONDITIONS AND THEN ONLY AFTER ARRANGING TO PROVIDE TEMPORARY GUARDED SERVICE ACCORDING TO REQUIREMENTS INDICATED.
- B. NOTIFY ARCHITECT AND OWNER NO FEWER THAN TWO DAYS IN ADVANCE OF PROPOSED INTERRUPTION OF FIRE-ALARM SERVICE. DO NOT PROCEED WITH INTERRUPTION OF FIRE-ALARM SERVICE WITHOUT ARCHITECT'S AND OWNER'S WRITTEN PERMISSION.
- C. MAINTAIN EXISTING EQUIPMENT FULLY OPERATIONAL UNTIL NEW EQUIPMENT HAS BEEN TESTED AND ACCEPTED. AS NEW EQUIPMENT IS INSTALLED, LABEL IT "NOT IN SERVICE" UNTIL IT IS ACCEPTED. REMOVE LABELS FROM NEW EQUIPMENT WHEN PUT INTO SERVICE AND FROM EXISTING FIRE-ALARM EQUIPMENT "NOT IN SERVICE" UNTIL REMOVED FROM THE BUILDING.
- D. AFTER ACCEPTANCE OF NEW FIRE-ALARM SYSTEM, REMOVE EXISTING DISCONNECTED FIRE-ALARM EQUIPMENT AND WIRING.
- E. COMPLY WITH NFPA 72 FOR INSTALLATION OF FIRE-ALARM EQUIPMENT.
- F. VERIFY THAT EXISTING FIRE-ALARM SYSTEM IS OPERATIONAL BEFORE MAKING CHANGES OR CONNECTIONS. CONNECT NEW EQUIPMENT TO EXISTING CONTROL PANEL IN EXISTING PART OF THE BUILDING. CORRECT NEW EQUIPMENT TO EXISTING MONITORING EQUIPMENT AT THE SUPERVISING STATION. EXPAND, MODIFY, AND SUPPLEMENT EXISTING CONTROL AND MONITORING EQUIPMENT AS NECESSARY TO EXTEND EXISTING CONTROL AND MONITORING FUNCTIONS TO THE NEW POINTS. NEW COMPONENTS SHALL BE CAPABLE OF MERGING WITH EXISTING CONFIGURATION WITHOUT DEGRADING THE PERFORMANCE OF EITHER SYSTEM.
- G. COMPLY WITH NFPA 72, "SMOKE-SENSING FIRE DETECTORS" SECTION IN THE "INITIATING DEVICES" CHAPTER, FOR SMOKE-DETECTOR SPACING. COMPLY WITH NFPA 72, "HEAT-SENSING FIRE DETECTORS" SECTION IN THE "INITIATING DEVICES" CHAPTER, FOR HEAT-DETECTOR SPACING. SMOOTH CEILING SPACING SHALL NOT EXCEED 30 FEET (9.1 M). SPACING OF DETECTORS FOR IRREGULAR AREAS, FOR IRREGULAR CEILING CONSTRUCTION, AND FOR HIGH CEILING AREAS SHALL BE DETERMINED ACCORDING TO APPENDIX A OR APPENDIX B IN NFPA 72.
- H. LOCATE DETECTORS NOT CLOSER THAN 3 FEET (1 M) FROM AIR-SUPPLY DIFFUSER OR RETURN-AIR OPENING.
- I. LIGHTING FIXTURES: LOCATE DETECTORS NOT CLOSER THAN 12 INCHES (300 MM) FROM ANY PART OF A LIGHTING FIXTURE.
- J. DUCT SMOKE DETECTORS: COMPLY WITH NFPA 72 AND NFPA 90A. INSTALL SAMPLING TUBES SO THEY EXTEND THE FULL WIDTH OF DUCT.
- K. REMOTE STATUS AND ALARM INDICATORS: INSTALL NEAR EACH SMOKE DETECTOR AND EACH SPRINKLER WATER-FLOW SWITCH AND VALVE-TAMPER SWITCH THAT IS NOT READILY VISIBLE FROM NORMAL VIEWING POSITION.
- L. AUDIBLE ALARM-INDICATING DEVICES: INSTALL NOT LESS THAN 6 INCHES (150 MM) BELOW THE CEILING. INSTALL BELLS AND HORNS ON FLUSH-MOUNTED BACK BOXES AND THE DEVICE-OPERATING MECHANISM CONCEALED BEHIND A GRILLE.
- M. VISUAL ALARM-INDICATING DEVICES: INSTALL ADJACENT TO EACH ALARM BELL OR ALARM HORN AND AT LEAST 6 INCHES (150 MM) BELOW THE CEILING.
- N. PROVIDE FIELD TESTING AS REQUIRED BY THE AUTHORITIES HAVING JURISDICTION.
- O. VISUAL ALARMS SHALL BE PROVIDED IN EACH OF THE FOLLOWING AREAS: RESTROOMS AND ANY OTHER GENERAL USE AREAS, MEETING ROOMS, HALLWAYS, LOBBIES, AND ANY OTHER AREA OF COMMON USAGE.
- P. AUDIBLE ALARMS SHALL PROVIDE A SOUND THAT EXCEEDS THE AMBIENT SOUND LEVEL IN A ROOM OR SPACE BY AT LEAST 15 DBA OR EXCEEDS ANY MAXIMUM SOUND LEVEL WITH A DURATION OF 60 SECONDS BY 5 DBA, WHICHEVER IS LOUDER. SOUND LEVELS FOR ALARM SIGNALS SHALL NOT EXCEED 110 DBA.
- Q. VISUAL ALARM SIGNAL APPLIANCES SHALL BE INTEGRATED INTO THE BUILDING OR FACILITY ALARM SYSTEM. IF SINGLE STATION AUDIBLE ALARMS ARE PROVIDED THEN SINGLE STATION VISUAL SIGNALS SHALL BE PROVIDED.
- R. VISUAL ALARMS SHALL COMPLY WITH THE FOLLOWING REQUIREMENTS:
 1. THE LAMP SHALL BE A XENON STROBE TYPE OR EQUIVALENT.
 2. THE COLOR SHALL BE CLEAR OR WHITE.
 3. MAXIMUM PULSE DURATION SHALL BE 0.2 SECONDS WITH MAXIMUM DUTY CYCLE OF 40%.
 4. INTENSITY SHALL BE A MINIMUM OF 75 CANDELA.
 5. FLASH RATE SHALL BE A MINIMUM OF 1 HZ AND A MAXIMUM OF 3 HZ.
 6. THE APPLIANCE SHALL BE PLACED 8" ABOVE THE HIGHEST FLOOR LEVEL WITHIN THE SPACE OR 6" BELOW THE CEILING, WHICHEVER IS LOWER.
 7. IN GENERAL, NO PLACE IN ANY ROOM OR SPACE SHALL BE MORE THAN 50' FROM THE SIGNAL. IN LARGE ROOMS OR SPACES EXCEEDING 100' ACROSS, WITHOUT OBSTRUCTIONS 6' ABOVE THE FLOOR, SUCH AS AUDITORIUMS, DEVICES MAY BE PLACED AROUND THE PERIMETER, SPACED A MAXIMUM 100' APART, IN LIEU OF SUSPENDING APPLIANCES FROM THE CEILING.
 8. NO PLACE IN COMMON CORRIDORS OR HALLWAYS SHALL BE MORE THAN 50' FROM THE SIGNAL. SIGNALS SHALL NOT BE GREATER THAN 15' FROM THE END OF A CORRIDOR OR HALLWAY.



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MARK DESCRIPTION DATE

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