

INSTALL RACEWAYS CONTINUOUS BETWEEN CONNECTIONS TO OUTLETS, BOXES AND CABINETS WITH A MINIMUM POSSIBLE NUMBER OF BENDS AND NOT MORE THAN THE EQUIVALENT OF FOUR 90-DEGREE BENDS BETWEEN CONNECTIONS. USE MANUFACTURED ELBOWS FOR ALL 45- AND 90-DEGREE BENDS, UNLESS APPROVED BY THE ENGINEER IN ADVANCE. MAKE OTHER BENDS SMOOTH AND EVEN AND WITHOUT FLATTENING RACEWAY OR FLAMING GALVANIZED OR ENAMEL. RADIUS OF BENDS SHALL BE AS LONG AS POSSIBLE AND NEVER SHORTER THAN THE CORRESPONDING TRADE ELBOW.

USE LONG RADIUS ELBOWS FOR ALL UNDERGROUND INSTALLATIONS, WHERE NECESSARY OR INDICATED.
SECURELY FASTEN RACEWAYS IN PLACE WITH APPROVED STRAPS, HANGERS AND STEEL SUPPORTS AS REQUIRED. ATTACH RACEWAY SUPPORTS TO THE BUILDING STRUCTURE. HANG SINGLE RACEWAYS FOR FEEDERS WITH MALLEABLE SPLIT RING HANGERS WITH RIGID AND TURNBUCKLE SUSPENSION FROM INSERTS SPACED NOT OVER 10 FEET APART IN CONSTRUCTION ABOVE. CLAMP GROUPS OF HORIZONTAL FEEDER RACEWAYS TO STEEL CHANNELS THAT ARE SUSPENDED FROM INSERTS SPACED NOT OVER 10 FEET APART IN CONSTRUCTION ABOVE. SECURELY CLAMP VERTICAL FEEDER RACEWAYS TO STRUCTURAL STEEL MEMBERS ATTACHED TO STRUCTURE. INSTALL CABLE CLAMPS FOR SUPPORT OF VERTICAL FEEDERS WHERE REQUIRED. ADD RACEWAY SUPPORTS WITHIN 12 INCHES OF ALL BENDS, ON BOTH SIDES OF THE BENDS. DO NOT SUPPORT RACEWAYS FROM SUSPENDED CEILING COMPONENTS.

REAM RACEWAY ENDS THOROUGHLY CLEAN RACEWAYS BEFORE INSTALLATION, AND KEEP CLEAN AFTER INSTALLATION. PLUG OR COVER OPENINGS AND BOXES AS REQUIRED TO KEEP RACEWAYS CLEAN DURING CONSTRUCTION AND FISH ALL RACEWAYS CLEAN OF OBSTRUCTIONS BEFORE PULLING CONDUCTORS Wires. PROVIDE RACEWAYS OF AMPLE SIZE FOR PULLING OF WIRE AND NOT SMALLER THAN CODE REQUIREMENTS AND NOT LESS THAN 1/2-INCH IN SIZE, UNLESS INDICATED OTHERWISE ON DRAWINGS, HOMERUNS CONTAINING MORE THAN ONE BRANCH CIRCUIT SHALL NOT BE LESS THAN 3/4-INCH IN SIZE.

PROTECT ALL RACEWAY INSTALLATIONS AGAINST DAMAGE DURING CONSTRUCTION. REPAIR ALL RACEWAYS DAMAGED OR MOVED OUT OF LINE AFTER ROUTING-IN TO MEET ENGINEER'S APPROVAL WITHOUT ADDITIONAL COST TO THE OWNER.

ALIGN AND INSTALL TRUE AND PLUMB ALL RACEWAY TERMINATIONS AT PANELBOARDS, SWITCHBOARDS, MOTOR CONTROL EQUIPMENT AND JUNCTION BOXES.

INSTALL APPROVED EXPANSION/DEFLECTION FITTINGS WHERE RACEWAYS PASS THROUGH (IF EMBEDDED) OR ACROSS (IF EXPOSED) EXPANSION JOINTS. ALSO WHEN USING RIGID RACEWAY IN EXPOSED ENVIRONMENTS IN ACCORDANCE WITH THE NEC AND INSTALLATION/CONSTRUCTION PROPERTIES OF RNC OR RAC.

INSTALL A PULL WIRE IN EACH EMPTY RACEWAY THAT IS LEFT FOR INSTALLATION OF CONDUCTORS OR CABLES UNDER OTHER DIVISIONS OR CONTRACTS. USE POLYPROPYLENE OR MONOFILAMENT PLASTIC LINE WITH NOT LESS THAN 200-LB TENSILE STRENGTH. LEAVE AT LEAST 24 INCHES OF SLACK AT EACH END OF PULL WIRE.

MAKE ALL JOINTS AND CONNECTIONS IN A MANNER THAT WILL ENSURE MECHANICAL STRENGTH AND ELECTRICAL CONTINUITY.

10B-1.2 BUSHINGS AND LOCKNUTS
RIGIDLY TERMINATE CONDUITS ENTERING SHEET METAL ENCLOSURES TO THE ENCLOSURE WITH A BUSHING AND LOCKNUT ON THE INSIDE AND A LOCKNUT OR AN APPROVED HUB ON THE OUTSIDE. CONDUIT SHALL ENTER THE ENCLOSURE SQUARELY.

PROVIDE BUSHINGS AND LOCKNUTS MADE OF GALVANIZED MALLEABLE IRON WITH SHARP, CLEAN-CUT THREADS.

WHERE EMT ENTERS A BOX, PROVIDE APPROVED EMT COMPRESSION CONNECTORS.

USE INSULATED, GROUNDING, OR COMBINATION, BUSHINGS WHEREVER CONNECTION IS SUBJECT TO VIBRATION OR MOISTURE, WHEN REQUIRED BY NFPA 70, OR BOTH.

10B-1.4 CONDUCTORS AND CABLES
CONDUCTOR MATERIAL:

ANNEALED (SOFT) COPPER COMPLYING WITH ICEA S-66-68/NEMA WC70.

TERMINATIONS: TINNED, COMPRESSION OR MECHANICAL TYPE ONLY. UL-LISTED FOR COPPER AND ALUMINUM CONDUCTORS AT 75 DEGREES C MINIMUM. CONDUCTOR INSULATION TYPES: 90 DEGREE C RATED, TYPE THHN/THWN-2 OR XHHW-2 COMPLYING WITH ICEA S-66-68/NEMA WC70.

SIZES OF CONDUCTORS AND CABLES INDICATED OR SPECIFIED ARE IN AMERICAN WIRE GAGE (AWG - BROWN AND SHARPE).

ALL FEEDER AND BRANCH CIRCUIT CONDUCTORS NO. 8 AWG AND LARGER: STRANDED.

ALL CONDUCTORS, NO. 10 AWG AND SMALLER: SOLID COPPER

ALL BRANCH CIRCUIT WIRING: NOT SMALLER THAN NO. 12 AWG. IF NO CONDUCTOR SIZE IS INDICATED ON THE DRAWINGS FOR A BRANCH CIRCUIT, PROVIDE CONDUCTORS AND CONDUIT SIZED PER NFPA 70 AND BASED ON THE INDICATED BRANCH CIRCUIT OVERCURRENT PROTECTIVE DEVICE (OCPD) RATING AND NUMBER OF POLES, WHERE NO CIRCUIT SIZE (I.E. CONDUCTORS AND OCPD) IS INDICATED ON THE DRAWINGS FOR A BRANCH CIRCUIT, PROVIDE THREE NO. 12 AWG CONDUCTORS, IN 3/4-INCH RACEWAY, AND A 20A CIRCUIT BREAKER.

CONTROL WIRING: STRANDED COPPER CONDUCTORS, 600V INSULATION, OF THE PROPER TYPE, SIZE AND NUMBER AS REQUIRED TO ACCOMPLISH SPECIFIED FUNCTION. MINIMUM SIZE: NO. 14 AWG, UNLESS NOTED OTHERWISE.

FLEXIBLE CORDS AND CABLES: STRANDED COPPER CONDUCTORS FOR ALL, UNLESS NOTED OTHERWISE.

SPECIAL PURPOSE CONDUCTORS AND CABLES, SUCH AS LOW VOLTAGE CONTROL AND SHIELDED INSTRUMENT WIRING, UNLESS INDICATED OTHERWISE, SHALL BE AS RECOMMENDED BY THE SYSTEM EQUIPMENT MANUFACTURER.

TYPE MC CABLE: 600V, UNJACKETED; ANSI E119 AND E814, UL STANDARDS 44 OR B3 (AS APPLICABLE), AND 1569; NFPA 70 ARTICLE 330; ALUMINUM OR GALVANIZED STEEL INTERLOCKED ARMOR, THIN OR XHHW INSULATED CONDUCTORS, COLOR CODE: ICEA METHOD 1, WITH GREEN INSULATED GROUNDING CONDUCTOR

10B-1.5 INSTALLATION OF CONDUCTORS AND CABLES

INSTALL ALL WIRING IN APPROVED RACEWAY AND ENCLOSURES, EXCEPT WHERE SPECIFIED OR INDICATED OTHERWISE ON DRAWINGS.

WHERE SPECIFIED OR INDICATED FOR DIRECT-BURIED CABLES WHERE TYPE MC CABLE IS INDICATED OR SPECIFIED AS ACCEPTABLE.

INSTALL ALL CONDUCTORS AND CABLE IN RACEWAYS CONTINUOUS WITHOUT TAPS OR SPLICES. SPLICE OR TAP ONLY IN APPROVED BOXES AND ENCLOSURES WITH APPROVED SOLDERLESS CONNECTORS OR CRIMP CONNECTORS AND TERMINAL BLOCKS FOR CONTROL WIRING, AND KEEP TO THE MINIMUM REQUIRED. INSULATE ALL SPLICES, TAPS, AND JOINTS AS REQUIRED BY CODES.

ALL MATERIALS USED TO TERMINATE, SPLICE OR TAP CONDUCTORS: DESIGNED FOR PROPERLY SIZED FOR, AND UL LISTED FOR THE SPECIFIC APPLICATION AND CONDUCTORS INVOLVED, AND INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, USING THE MANUFACTURER'S RECOMMENDED TOOLS.

WHERE WIRING IS INDICATED AS INSTALLED, BUT THE CONNECTION IS INDICATED "FUTURE" OR "BY OTHER DIVISION, TRADE, OR CONTRACTS," LEAVE A MINIMUM 3-FOOT "PIGTAIL" AT THE BOX, TAPE THE ENDS OF THE CONDUCTORS, AND COVER THE BOX.

IN GENERAL, THE DIRECTION OF BRANCH CIRCUIT "HOME RUN" ROUTING IS INDICATED ON THE DRAWINGS, COMPLETE WITH CIRCUIT NUMBERS AND PANELBOARD DESIGNATION, CONTINUE ALL SUCH "HOME RUN" WIRING TO THE DESIGNATED PANELBOARD, AS THOUGH "CIRCUIT RUNS" WERE INDICATED IN THEIR ENTRY.

COMMON OR SHARED NEUTRALS ARE NOT ALLOWED UNLESS SHOWN ON THE DRAWINGS TO BE USED OR SPECIFICALLY NOTED TO BE ALLOWED.

WHERE MULTI-WIRE BRANCH CIRCUITS (I.E. SHARED NEUTRAL) ARE ALLOWED, THEY SHALL BE PROVIDED WITH A MEANS THAT WILL SIMULTANEOUSLY DISCONNECT ALL UNGROUNDED CONDUCTORS AT THE POINT THE BRANCH CIRCUIT ORIGINATES. MULTI-POLE BREAKERS OR 3-SINGLE-POLE BREAKERS WITH A HANDLE TIE ARE TWO EXAMPLES.

WHEN MULTIPLE HOME RUNS ARE COMBINED INTO A SINGLE RACEWAY OR THE NUMBER OF CONDUCTORS EXCEEDS FOUR (CONDUCTOR COUNT IS THE SUM OF THE COMBINATION OF PHASE AND NEUTRAL CONDUCTORS), THE FOLLOWING REQUIREMENTS APPLY, WHICH ARE IN ADDITION TO THOSE IN NFPA 70:

NORMAL OR NON-ESSENTIAL CIRCUITS:

MAXIMUM OF 16 CONDUCTORS IN A SINGLE RACEWAY, PROVIDED THAT EIGHT CONDUCTORS IN A RACEWAY, MINIMUM RACEWAY SIZE 3/4-INCH, FOR GREATER THAN EIGHT CONDUCTORS, MINIMUM RACEWAY SIZE 1-INCH, DO NOT INSTALL ANY OTHER TYPE OF CIRCUIT IN THIS RACEWAY.

THE MINIMUM WIRE SIZE FOR ALL CONDUCTORS IN THIS RACEWAY: NO. 10 AWG.

ONLY 15A AND 20A BRANCH CIRCUIT HOMERUNS MAY BE COMBINED INTO ONE RACEWAY.

GFCI CIRCUITS:

DO NOT USE MULTI-CONDUCTOR CIRCUITS, WITH A SHARED NEUTRAL, FOR ANY GFCI CIRCUIT BREAKER OR RECEPTACLE CIRCUIT.

EMERGENCY POWER CIRCUITS - INCLUDES ALL CIRCUITS COVERED UNDER ARTICLES 700, 701 AND 702.

MAXIMUM OF EIGHT CONDUCTORS IN A SINGLE RACEWAY. MINIMUM RACEWAY SIZE 3/4-INCH. DO NOT INSTALL ANY OTHER TYPE OF CIRCUIT IN THIS RACEWAY.

ONLY 15A AND 20A BRANCH CIRCUIT HOMERUNS MAY BE COMBINED INTO ONE RACEWAY.

FOR BRANCH CIRCUITS FED FROM GFCI CIRCUIT BREAKERS, LIMIT THE ONE-WAY CONDUCTOR LENGTH TO 100 FEET BETWEEN THE PANELBOARD AND THE MOST REMOTE RECEPTACLE OR LOAD ON THE GFCI CIRCUIT.

PROPERLY IDENTIFY ALL TERMINAL BLOCKS AND WIRE TERMINALS FOR CONTROL WIRING WITH VINYL STICK-ON MARKERS OR EQUIVALENT. PROVIDE ENGINEER WITH A LIST OF PROPOSED IDENTIFYING NUMBERS FOR REVIEW PRIOR TO INSTALLING MARKERS.

PROVIDE AN EQUIPMENT-GROUNDING CONDUCTOR, OR BONDING JUMPER, AS APPLICABLE, IN ALL FEEDERS AND BRANCH CIRCUITS, SIZED IN ACCORDANCE WITH NFPA 70 TABLES 250.06 OR 250.122, AS APPLICABLE, UNLESS INDICATED AS LARGER ON THE DRAWINGS.

WIRING SHALL HAVE INSULATION OF THE PROPER COLOR TO MATCH COLOR CODE SYSTEM IN THE TABLE BELOW UNLESS THERE IS A COLOR SYSTEM CURRENTLY IN USE BY THE FACILITY, IN WHICH CASE THE COLORS ARE TO MATCH THE EXISTING SYSTEM. IN LARGER SIZES, WHERE PROPERLY SOLDERED INSULATION IS NOT AVAILABLE, USE WIRE PLASTIC ELECTRICAL TAPE OF THE APPROPRIATE COLOR AROUND EACH CONDUCTOR AT ALL TERMINATION POINTS, JUNCTION AND PULL BOXES.

PANELBOARDS: SQUARE D TYPE NQDD OR NF, AS APPLICABLE, BASED ON VOLTAGE AND AMPERE RATINGS AND REQUIRED SHORT-CIRCUIT INTERRUPTING RATINGS AS SCHEDULED ON THE DRAWINGS, OR APPROVED EQUIVALENT BY SIEMENS, CUTLER HAMMER, OR GENERAL ELECTRIC, COMPLETE WITH BOLT-ON THERMAL MAGNETIC, MOLDED CASE CIRCUIT BREAKERS ASSEMBLED IN A DEAD-FRONT FINISHED CABINET CONTAINING A TYPEWRITTEN CARD DIRECTORY INDICATING EXACTLY WHAT EACH CIRCUIT BREAKER CONTROL IS, FULLY RATED AND WITH THE INTEGRATED SHORT CIRCUIT CURRENT RATINGS INDICATED ON THE DRAWINGS. PLUG-IN TYPE BREAKERS WILL NOT BE ACCEPTABLE. ALL TWO AND THREE POLE BREAKERS: COMMON TRIP TYPE. BREAKERS USED AS SWITCHES FOR 120V OR 277V LIGHTING CIRCUITS: APPROVED FOR THE PURPOSE AND MARKED "SWD". BREAKERS USED FOR THE PROTECTION OF HVAC AND REFRIGERATION EQUIPMENT: HACR TYPE.

10B-1.6 JUNCTION BOXES, PULL BOXES, CABINETS AND WIREWAYS

PROVIDE JUNCTION BOXES, PULL BOXES, CABINETS AND WIREWAYS WHEREVER NECESSARY FOR PROPER INSTALLATION OF VARIOUS ELECTRICAL SYSTEMS ACCORDING TO NFPA 70 AND WHERE INDICATED ON THE DRAWINGS. SIZE AS REQUIRED FOR THE SPECIFIC FUNCTION OR AS REQUIRED BY NFPA 70, WHICHEVER IS LARGER. CONSTRUCTION SHALL BE OF A NEMA DESIGN SUITABLE FOR THE ENVIRONMENT INSTALLED.

JUNCTION BOXES INSTALLED BEHIND WALL CASES, AND IN OR ON OTHER STORE FIXTURES, BOXES, WITH HUBS AND CONNECTIONS SPECIFIED, SHALL BE 4-INCH SQUARE OR LARGER, WITH GALVANIZED COVERS.

HORIZONTALLY MOUNT JUNCTION BOXES UNDER CENTER FIXTURES (AND CASES), HANGY BOXES OR 4-INCH SQUARE BOXES WITH TOPS OF BOXES NOT MORE THAN 3- 1/2 INCHES ABOVE THE FLOOR. SIZE JUNCTION BOXES TO ADEQUATELY CONTAIN ALL REQUIRED CONDUCTORS AND SPLICES.

10B-1.7 OUTLET BOXES

ALL OUTLETS INCLUDING LIGHT FIXTURE, SWITCH, RECEPTACLE, AND SIMILAR OUTLETS: NATIONAL ELECTRICAL, APPLETON, STEEL CITY, RACO, OR APPROVED EQUAL, GALVANIZED STEEL, KNITABLE IN DESIGN, SUITABLE IN DESIGN TO THE PURPOSE THEY SERVE AND THE SPACE THEY OCCUPY. SIZE AS REQUIRED FOR THE SPECIFIC FUNCTION OR AS REQUIRED BY NFPA 70, WHICHEVER IS LARGER. SET ALL OUTLET BOXES IN WALLS, COLUMNS, FLOORS, OR CEILING SO THEY ARE PROTECTED BY THE FINISHED SURFACE. ACCURATELY SET AND RIGIDLY SECURED IN POSITION. PROVIDE PLASTER RINGS, EXTENSION RINGS AND/OR MASONRY RINGS AS REQUIRED FOR FLUSH MOUNTING. PROVIDE APPROVED CAST WET, OR HARSH CONDITIONS.

COORDINATE LOCATIONS OF OUTLET BOXES, OUTLETS ARE ONLY APPROXIMATELY LOCATED ON THE SMALL SCALE DRAWINGS. USE GREAT CARE IN THE ACTUAL LOCATION OF OUTLET, CONSULTING THE VARIOUS LARGE SCALE DETAILED DRAWINGS USED BY OTHER DIVISION TRADES, AND BY SECURING DEFINITE LOCATIONS FROM THE ARCHITECT

10B-1.8 MOUNTING HEIGHTS

UNLESS NOTED OTHERWISE, INSTALL WIRING DEVICES AS INDICATED BELOW (NOTE: ALL DIMENSIONS ARE TO THE BOTTOM OF THE OUTLET BOX UNLESS NOTED OTHERWISE):

RECEPTACLES:

VERTICALLY ALIGNED WITH THE GROUND SLOT MOUNTED AT THE TOP: 16 INCHES ABOVE FINISHED FLOOR.

HORIZONTALLY ALIGNED, WITH NEUTRAL SLOT MOUNTED AT THE BOTTOM: 16 INCHES ABOVE FINISHED FLOOR.

FOR 36-INCH HIGH COUNTER TOPS: 44 INCHES ABOVE FINISHED FLOOR, VERTICALLY ALIGNED.

FOR 34-INCH HIGH COUNTER TOPS: 40 INCHES ABOVE FINISHED FLOOR, VERTICALLY ALIGNED.

MECHANICAL AND ELECTRICAL EQUIPMENT ROOMS AND JANITORS CLOSETS: 44 INCHES ABOVE FINISHED FLOOR, VERTICALLY ALIGNED.

GFCI RECEPTACLES: SAME AS GENERAL.

ISOLATED GROUND RECEPTACLES: SAME AS GENERAL RECEPTACLES.

CONCRETE BLOCK WALLS: DIMENSIONS ABOVE MAY BE ADJUSTED SLIGHTLY, AS REQUIRED TO COMPENSATE FOR VARIABLE JOINT DIMENSIONS, SUCH THAT BOTTOM OR TOP OF BOXES, AS APPLICABLE, ARE AT BLOCK JOINTS.

SWITCHES:

GENERAL: 48 INCHES ABOVE FINISHED FLOOR.

ABOVE COUNTERS: SAME AS FOR RECEPTACLES.

CONCRETE BLOCK WALLS: 40 INCHES ABOVE FINISHED FLOOR (DIMENSION ADJUSTED SLIGHTLY, AS REQUIRED TO COMPENSATE FOR VARIABLE JOINT DIMENSIONS, SUCH THAT BOTTOM OF BOXES ARE AT BLOCK JOINTS).

TELEPHONE/DATA OUTLET BOXES:

GENERAL: MATCH MOUNTING HEIGHT OF OR ADJACENT WIRING DEVICE LISTED ABOVE.

WALL-MOUNTED TELEPHONE: 16 INCHES ABOVE FINISHED FLOOR.

OTHER THAN THE ABOVE, REFER TO PARAGRAPHS, ARTICLES, SECTIONS, DIVISIONS, OR DRAWINGS FOR DETAILS ON MOUNTING HEIGHTS FOR SPECIFIC EQUIPMENT OR SYSTEM WIRING DEVICES.

THE CATEGORY NUMBER LISTED FOR WIRING DEVICES ARE GENERALLY FOR 20A RATED DEVICES. IF 15A RATED DEVICES ARE INDICATED ON THE DRAWINGS OR REQUIRED BY CIRCUIT OR WIRING LIMITATIONS, PROVIDE WIRING DEVICES EQUIVALENT TO THOSE SPECIFIED FOR 20A, BUT RATED FOR 15A.

ALL RECEPTACLES LOCATED OUTDOORS OR IN DAMP OR WET LOCATIONS: SHALL BE LISTED AS WEATHER RESISTANT, DESIGNATED BY A "WR" ON THE FACELATE.

PROVIDE THE FOLLOWING WIRING DEVICES WHERE SHOWN ON DRAWINGS OR REQUIRED. MINOR CHANGES RELATIVE TO THE LOCATION OF ELECTRICAL EQUIPMENT MAY BE MADE TO COMPLY WITH STRUCTURAL AND BUILDING REQUIREMENTS AS DETERMINED IN THE COURSE OF CONSTRUCTION. PROVIDE ALL WIRING DEVICES OF THE SAME MANUFACTURE, AND NOT MIXED ON THE PROJECT, TO THE MAXIMUM EXTENT POSSIBLE. PROVIDE COLOR OF TOGGLES AND RECEPTACLES AS REQUESTED BY THE ENGINEER: REFER TO DETAIL SHOWING RECEPTACLES TABLE.

TYPE OF DEVICE	HUBBELL	PASS & SEYMOUR	LEVITON	COOPER
DUPLEX RECEPTACLE	BR20	CR20	CR20	CR20
ISOLATED GROUND RECEPTACLE	IG20CR	IGS362	5362-IG	IGS362
SIMPLEX RECEPTACLE	HLB 5361	5361	5261	5361
GFCI RECEPTACLE	GF20LA	2095	7899-H	VGF20
QUAD / 4-POLE	HLB 420	420H	21254	N/A
SINGLE POLE SWITCH	DS120	CS20AC1	CSB1-20	CSB120
DOUBLE POLE SWITCH	DS220	CSB2-20	CSB220	
THREE-WAY SWITCH	DS230	CS20AC3	CSB3-20	CSB320

10B-1.11 SWITCH AND OUTLET COVER PLATES

SWITCH AND OUTLET PLATES COLORED, SMOOTH NYLON, BY THE SAME MANUFACTURER AS THE WIRING DEVICES, WHEREVER POSSIBLE. VERIFY DESIRED MATERIALS AND COLORS.

INSTALL SWITCH AND OUTLET PLATES WITH ARCHITECT BEFORE INSTALLATION. SWITCH PLATES IN UNFINISHED ROOMS AND SPACES: STAMPED STEEL, CADMIUM PLATED. INSTALL GROUPS OF SWITCHES UNDER ONE GANGE PLATE USUALLY HORIZONTALLY, OR, WHERE REQUIRED BY DETAILS, VERTICALLY. SET ALL COVER PLATES PLUMB, PARALLEL, AND FINISHED FLUSH WITH THE WALL.

10B-2 DISTRIBUTION AND CONTROL EQUIPMENT

10B-2.1 LIGHTING AND APPLIANCE PANELBOARDS

PANELBOARDS: SQUARE D TYPE NQDD OR NF, AS APPLICABLE, BASED ON VOLTAGE AND AMPERE RATINGS AND REQUIRED SHORT-CIRCUIT INTERRUPTING RATINGS AS SCHEDULED ON THE DRAWINGS, OR APPROVED EQUIVALENT BY SIEMENS, CUTLER HAMMER, OR GENERAL ELECTRIC, COMPLETE WITH BOLT-ON THERMAL MAGNETIC, MOLDED CASE CIRCUIT BREAKERS ASSEMBLED IN A DEAD-FRONT FINISHED CABINET CONTAINING A TYPEWRITTEN CARD DIRECTORY INDICATING EXACTLY WHAT EACH CIRCUIT BREAKER CONTROL IS, FULLY RATED AND WITH THE INTEGRATED SHORT CIRCUIT CURRENT RATINGS INDICATED ON THE DRAWINGS. PLUG-IN TYPE BREAKERS WILL NOT BE ACCEPTABLE. ALL TWO AND THREE POLE BREAKERS: COMMON TRIP TYPE. BREAKERS USED AS SWITCHES FOR 120V OR 277V LIGHTING CIRCUITS: APPROVED FOR THE PURPOSE AND MARKED "SWD". BREAKERS USED FOR THE PROTECTION OF HVAC AND REFRIGERATION EQUIPMENT: HACR TYPE.

10B-2.2 CIRCUIT BREAKERS IN EXISTING PANELBOARDS

PROVIDE NEW CIRCUIT BREAKERS, FOR INSTALLATION IN EXISTING PANELBOARDS, OF THE SAME MANUFACTURER, TYPE AND SHORT CIRCUIT CURRENT INTERRUPTING RATINGS AS THE EXISTING PANELBOARD CIRCUIT BREAKERS.

WHEN THERE IS NOT ENOUGH ROOM IN THE EQUIPMENT TO SHOW ALL THE LEGITIMATE SERIES RATED COMBINATIONS, REFERENCE A BULLETIN SUPPLIED WITH THE PANELBOARD, PER UL 67.

10B-2.3 DISCONNECT (SAFETY) SWITCHES

DISCONNECT (SAFETY) SWITCHES: SQUARE D, SIEMENS, CUTLER HAMMER, OR GENERAL ELECTRIC FUSED OR NON-FUSED (AS INDICATED ON DRAWINGS OR REQUIRED) NEMA KS1, HEAVY DUTY, EXTERNAL OPERATED, VISIBLE LABEL SAFTY SWITCHES: NEMA ENCLOSURE TYPE INDICATED ON THE DRAWINGS OR SUITABLE FOR THE ENVIRONMENT IN WHICH INSTALLED. BASED ON FUSIBLE SWITCH AND FUSE SIZES INDICATED, INCLUDE CLASS R, J, OR I FUSE PROVISIONS AS APPLICABLE.

WHERE INDICATED, PROVIDE FUSIBLE SWITCHES PERMANENTLY LABELED AS SUITABLE FOR USE AS SERVICE ENTRANCE EQUIPMENT, W/UL LISTED LABEL, COMPLETE WITH NEUTRAL AND GROUND ASSEMBLIES, SUITABLE FOR THE SIZES OF CONDUCTORS INDICATED. DO NOT DOUBLE-LUG ANY TERMINATIONS NOT SPECIFICALLY LISTED AS SUITABLE FOR MORE THAN ONE CONDUCTOR.

PROVIDE SWITCHES WHERE NOT FURNISHED WITH THE STARTING EQUIPMENT, AT ALL OTHER POINTS REQUIRED BY NFPA 70, AND WHERE INDICATED ON THE DRAWINGS.

10B-2.4 FUSES

PROVIDE EACH CIRCUIT AND SET OF FUSE SLIPS THROUGHOUT THE WORK WITH BUSSMANN, FERRAZ SHAWMUT, OR LITTEL FUSE FUSES, TYPES AND TYPES AS REQUIRED OR INDICATED.

ALL FUSES LARGER THAN 600A, UL CLASS L, SIMILAR TO TYPE KRC-BUSSMANN LOW PEAK OR EQUAL. FUSES USED TO PROTECT MOTORS, UL CLASS RK5, BUSSMANN FUSETRON OR EQUAL. FUSES USED TO PROTECT ALL OTHER ELECTRICAL EQUIPMENT, UL CLASS RK1 ELEMENT BUSSMANN LPSLOW OR EQUAL. ALL FUSED DEVICES SHALL BE LABELED AS TO TYPE AND SIZE OF FUSE REQUIRED.

10B-2.5 DRY-TYPE TRANSFORMERS

TRANSFORMERS: GENERAL PURPOSE, UL-LISTED/LABELED, COMPLY WITH NEMA ST-1 STANDARDS.

INSULATION CLASS: FOR THREE PHASE TRANSFORMERS: LESS THAN 15 KV: ALL AND SINGLE PHASE - 165 DEGREES; UL-COMPONENT-RECOGNIZED INSULATION SYSTEM WITH A MAXIMUM OF 115 DEGREE C RISE ABOVE 4-40 KV: 180 DEGREES. FOR THREE PHASE TRANSFORMERS 15 KV AND LARGER: 180 DEGREES. FOR COMPONENT-RECOGNIZED INSULATION SYSTEM WITH A MAXIMUM OF 125 DEGREE C RISE ABOVE 40 DEGREE C AMBIENT TEMPERATURE, UL-COMPONENT-RECOGNIZED INSULATION SYSTEM REPLACES THE UL1446 INSULATION RATING SYSTEM THAT USES WINDERS.

PHASES, VOLTAGES, AND SIZES: AS INDICATED ON THE DRAWING.

SOUND LEVEL: NOT EXCEEDING 80A BELLS THAN NEMA STANDARDS FOR THE SIZES INDICATED.

FULL CAPACITY PRIMARY WINDINGS: 25 KVA: ONE 5 PERCENT TAP ABOVE AND ONE 5 PERCENT TAP BELOW; 30 KVA TO 300 KVA: SIX 2.5 PERCENT TAPS (2 ABOVE, 4 BELOW); ABOVE 500 KVA: FOUR 2 PERCENT TAPS (2 ABOVE, 2 BELOW).

TRANSFORMER FRAME ASSEMBLIES: MOUNTED ON INTEGRAL VIBRATION ABSORBING PADS; TRANSFORMERS 75 KVA AND LARGER SHALL BE WALL MOUNTED UNLESS INDICATED OTHERWISE. TRANSFORMERS 15 KVA AND SMALLER MAY BE WALL MOUNTED WHEN THE WALLS ARE FINISHED AND FLOOR MOUNTED OTHERWISE.

TRANSFORMERS SHALL BE PROTECTED TO A 4 INCH THICK KEEPING PAD WITH INSULATION PADS, WALL MOUNTED OR SUSPENDED TRANSFORMERS SHALL HAVE CONDUIT FROM THE INSULATING VIBRATION FROM THE SUPPORT.

MAKE ALL CONDUIT CONNECTIONS TO TRANSFORMERS WITH FLEXIBLE CONDUIT, WITH AT LEAST 6 INCHES CLEARANCE IN ALL DIRECTIONS.

TRANSFORMER ENCLOSURES, FULLY ENCLOSED (EXCEPT FOR VENTILATION OPENINGS), NEMA 2, Drip-PROOF, OR HEAVY GAUGE SHEET STEEL CONSTRUCTION.

PROVIDE ENERGY-EFFICIENT TRANSFORMERS COMPLYING WITH NEMA TP-1, WHEN TESTED IN ACCORDANCE WITH NEMA TP-1.

K-RATED TRANSFORMERS SHALL BE PROVIDED AS INDICATED ON THE DRAWINGS AND BE LISTED FOR 115 DEGREE C RISE.

MANUFACTURERS: SQUARE D, CUTLER HAMMER, GENERAL ELECTRIC, HAMMOND, ACME OR SIEMENS.

PROVIDE GROUNDING TO COMPLY WITH NEC SECTION 250.30(A).

10B-2.6 FRACTIONAL HORSEPOWER MANUAL MOTOR STARTERS

FRACTIONAL HORSEPOWER MANUAL MOTOR STARTERS SHALL BE:

SQUARE D CLASS 25 10, TYPE F GENERAL ELECTRIC C101 SIEMENS MSF SERIES WESTINGHOUSE M21 SERIES CUTLER HAMMER 9101 SERIES

MANUAL MOTOR STARTERS FOR FRACTIONAL HORSEPOWER SINGLE PHASE MOTORS SHALL CONSIST OF A MOTOR OPERATING SWITCH EQUIPPED WITH MELTING ALLOY THERMAL OVERLOAD RELAY. THERMAL UNIT SHALL BE OF ONE PIECE CONSTRUCTION AND INTERCHANGEABLE. STARTER SHALL BE INOPERATIVE IF THERMAL UNIT IS REMOVED.

PROVIDE FLUSH MOUNTED UNITS IN FINISHED AREAS AND SURFACE MOUNTED UNITS IN UNFINISHED AREAS. STARTERS SHALL HAVE NEMA 1 GENERAL PURPOSE ENCLOSURE, UNLESS OTHERWISE INDICATED, AND BE RATED FOR THE MOTOR HORSEPOWER REQUIRED.

PROVIDE MANUAL MOTOR STARTERS WITH AN INTEGRAL PULL LIGHT.

10B-3 LIGHT FIXTURES, LAMPS AND DRIVERS

10B-3.1 LIGHT FIXTURE LOCATIONS

LIGHT FIXTURES SHOWN ON THE ELECTRICAL DRAWINGS REPRESENT GENERAL ARRANGEMENTS ONLY. REFER TO ARCHITECTURAL DRAWINGS FOR MORE EXACT LOCATIONS. COORDINATE LOCATION WITH ALL OTHER TRADES BEFORE INSTALLATION TO AVOID CONFLICTS. COORDINATE LIGHT FIXTURE LOCATIONS IN MECHANICAL ROOMS WITH FINAL INSTALLED PIPING AND DUCTWORK LAYOUTS.

10B-3.2 LIGHT FIXTURES

PROVIDE LIGHT FIXTURES AS SCHEDULED ON DRAWINGS, INCLUDING ALL LAMPS, ALL NECESSARY ACCESSORIES, MATERIAL AND LABOR TO SECURELY HANG, CLEAN, AND MAKE LIGHT FIXTURES COMPLETELY READY FOR USE. LIGHT FIXTURE MODEL NUMBERS SCHEDULED ON THE DRAWINGS SHOW ONLY THE MANUFACTURER, GRADE AND STYLE OF LIGHT FIXTURES REQUIRED, PROVIDE ALL HANGERS, SUPPORTS, AND MISCELLANEOUS HARDWARE REQUIRED TO INSTALL LIGHT FIXTURES, PROPER TRIM TO FIT EACH CEILING CONDITION ACTUALLY ENCOUNTERED; ADDITIONAL WIRES CONNECTED TO STRUCTURE TO CONFORM TO SEISMIC REQUIREMENTS WHERE REQUIRED BY THE APPLICABLE BUILDING CODE.

PACKAGING OF LIGHT FIXTURES WILL NOT BE ALLOWED. ONLY THOSE LUMINAIRES LISTED IN THE LIGHT FIXTURE SCHEDULE, OR APPROVED IN ACCORDANCE WITH SUBSTITUTION OF THESE SPECIFICATIONS, WILL BE ACCEPTED. WHERE THE LIGHT FIXTURE SCHEDULE INDICATES AN ALLOWANCE FOR A SPECIFIC LIGHT FIXTURE, THE PRICE IS A CONTRACTOR PROVIDED ALLOWANCE. ALL ADDITIONAL COSTS FOR FREIGHT, LAMPS, AND INSTALLATION OF LIGHT FIXTURE AND LAMPS.

SURFACE-MOUNT ALL LIGHT FIXTURES LOCATED IN AREAS WITH A CEILING BUT WITHOUT SUSPENDED CEILING UNLESS OTHERWISE INDICATED ON THE DRAWINGS. PROVIDE RIGID METAL SPACERS FINISHED IN WHITE ENAMEL BETWEEN THE TOP OF EACH LIGHT FIXTURE AND THE CEILING ABOVE TO MAINTAIN A 1-1/2-INCH SPACE. SPACERS SHALL BE APPROVED BEFORE INSTALLATION.

INSTALL ALL LIGHT FIXTURES LOCATED IN AREAS WITHOUT CEILING IMMEDIATELY BELOW THE ROOF-FRAMING MEMBERS, OR SUSPENDED FROM CHAIN HANGERS SUITABLE IN LENGTH TO PROVIDE THE INDICATED MOUNTING HEIGHT. HANGERS: "HYDROC" HANGER TYPE FOR OUTLET BOX MOUNTING, COMPLETE WITH GROUNDING RECEPTACLE, PLUS, 3-WIRE CORD AND NECESSARY CHAIN.

THROUGH WIRING OF RECESSED LIGHT FIXTURES, IN SUSPENDED CEILING, IS NOT PERMITTED. CONNECT EACH LIGHT FIXTURE BY A WHIP TO A JUNCTION BOX. PROVIDE CABLE WHIPS OF SUFFICIENT LENGTHS TO ALLOW FOR RELOCATING EACH LIGHT FIXTURE WITHIN A 5-FOOT RADIUS OF ITS INSTALLED LOCATION, BUT NOT EXCEEDING 6 FEET IN UNSUPPORTED LENGTHS.

10B-3.3 LED LAMPS AND LED CHIPS

PROVIDE LAMPS AS INDICATED ON THE DRAWINGS FOR ALL APPLICABLE LIGHT FIXTURES; OR, IF NOT INDICATED, AS RECOMMENDED BY THE LIGHT FIXTURE MANUFACTURER. IN ALL CASES, LAMPS SHALL BE COMPATIBLE WITH THE SPECIFIED LIGHT FIXTURE.

LAMPS SHALL BE AS MANUFACTURED BY GENERAL ELECTRIC, SYLVANIA OR PHILLIPS. LED CHIPS SHALL BE AS MANUFACTURED BY PHILIPS, OSRAM, GENERAL ELECTRIC, SAMSUNG, XIKATO, BRIDGELUX, CITIZEN, CREE, OR PRE-BID EQUAL, AS APPROVED BY THE ENGINEER.

LED'S SHALL HAVE MINIMUM CRI OF 82 FOR GENERAL OFFICE USE SPACES, AND A MINIMUM OF 90 CRI IN OTHER APPLICATIONS, UNLESS NOTED OTHERWISE. LED'S SHALL HAVE A MINIMUM L70 AT 50,000 HOURS BASED ON TM-21 ADDENDUM-A LIFETIME RATED DATA. LED CHIPS SHALL BE MANUFACTURED AND BINNED WITH A MAXIMUM 3-STEP MACADAM FLATTEN PROCESS WHICH EXCEEDS ANSI C78.374 CHROMATICITY STANDARDS.

ALL LAMPS SHALL BE WARRANTIES BY THE CONTRACTOR FOR MINIMUM 1 YEAR AGAINST ANY MANUFACTURER DEFECT OR FLICKERING.

10B-3.4 DRIVERS

LED DRIVERS SHALL BE INTERNAL TO THE LUMINAIRE UNLESS NOTED OTHERWISE.

LED DRIVERS SHALL HAVE A POWER FACTOR OF 0.9 OR HIGHER AND MAXIMUM 20% THD.

DRIVERS SHALL BE 0-10V DIMMABLE STANDARD UNLESS NOTED OTHERWISE. DIMMABLE 1% THD WITH FLICKER-FREE DIMMING. ANY DRIVERS THAT CAUSE LED CHIPS TO FLICKER SHALL BE RE-SELECTED AND REPLACED AT NO COST TO THE OWNER.

10B-3.5 LAMPS

PROVIDE LAMPS AS INDICATED ON THE DRAWINGS FOR ALL LIGHT FIXTURES, OR, IF NOT INDICATED, AS RECOMMENDED BY THE LIGHT FIXTURE MANUFACTURER. IN ALL CASES, LAMPS SHALL BE COMPATIBLE WITH THE SPECIFIED LIGHT FIXTURE. ACCEPTABLE LAMP MANUFACTURERS: GENERAL ELECTRIC, OSRAM/SYLVANIA, PHILIPS, OR VENTUS.

10B-3.6 EMERGENCY LIGHTING UNITS AND EXIT SIGNS

DESCRIPTION: SELF-CONTAINED UNIT COMPLYING WITH UL 924.

BATTERY: SEALED, MAINTENANCE-FREE, BATTERY, UL 924. BATTERY SHALL BE OF SUITABLE RATING AND CAPACITY TO SUPPLY AND MAINTAIN A NOT LESS THAN 91