

ELECTRICAL

On-Drawing

Specification

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SECTION 1
GENERAL REQUIREMENTS

GENERAL

THE WORK INCLUDES ALL LABOR, MATERIALS, EQUIPMENT, AND SERVICES NECESSARY TO COMPLETE THE WORK AS DESCRIBED AND SPECIFIED HEREIN.

MATERIAL AND EQUIPMENT QUALIFICATIONS

ALL MATERIALS AND APPARATUS REQUIRED FOR THE WORK, EXCEPT AS OTHERWISE SPECIFICALLY INDICATED, SHALL BE NEW AND REQUIRE APPROVAL BY THE OWNER. WHERE NO SPECIFIC MAKE OF MATERIAL, APPARATUS OR APPLIANCE IS MENTIONED, ANY FIRST-CLASS PRODUCT MADE BY A REPUTABLE MANUFACTURER SHALL BE SUBMITTED FOR OWNER REVIEW AND APPROVAL.

CONTRACTOR SHALL REVIEW ALL OTHER TRADES SCOPE OF WORK, SEQUENCE OF OPERATIONS PRIOR TO MATERIAL AND EQUIPMENT SUBMITTALS AS APPLICABLE.

ALL MATERIAL FOR THIS PROJECT SHALL COMPLY WITH THE BUY AMERICAN ACT.

EXISTING CONDITIONS FIELD SURVEY

CONTRACTOR SHALL VISIT SITE TO BECOME THOROUGHLY FAMILIAR WITH EXISTING CONDITIONS AND THEIR EFFECT ON THE WORK. BEFORE COMMENCING WORK EXAMINE EXISTING ADJOINING WORK ON WHICH THE NEW WORK IS IN ANY WAY DEPENDANT FOR PROPER INSTALLATION, OPERATION AND SERVICE AND REPORT ANY DISCREPANCIES WHICH WOULD INHIBIT THE PROPER INSTALLATION OF NEW WORK.

COORDINATION

COORDINATE THE WORK WITH WORK OF OTHER TRADES AND FIELD CONDITIONS. CAREFULLY CHECK SPACE REQUIREMENTS AND UTILITIES TO INSURE ALL EQUIPMENT CAN BE INSTALLED IN THE SPACES ALLOTTED THERETO AND COORDINATE ALL NECESSARY UTILITY SERVICE REQUIREMENTS. THE INSTALLATION OF NEW WORK MAY REQUIRE A PHASED INSTALLATION SEQUENCE. COORDINATE, PROTECT AND SCHEDULE WORK WITH WORK OF OTHER TRADES IN ACCORDANCE WITH THE REQUIRED CONSTRUCTION SCHEDULE.

INSTALL ALL WORK IN ACCORDANCE WITH EQUIPMENT MANUFACTURERS INSTALLATION INSTRUCTIONS.

CODES & STANDARDS

COMPLY WITH ALL CURRENT FEDERAL, STATE, CITY AND LOCAL CODES, STANDARDS, AND ORDINANCES INCLUDING NFPA, UTILITY STANDARDS, OWNERS INSURANCE CARRIER REQUIREMENTS AND LOCAL AUTHORITIES AND IN ACCORDANCE WITH THE RFP DOCUMENTS.

SECTION 2
ELECTRICAL SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

CODES, PERMITS AND INSPECTIONS:

THE INSTALLATION SHALL COMPLY WITH ALL LOCAL LAWS AND ORDINANCES, APPLICABLE TO ELECTRICAL INSTALLATIONS, AND WITH THE REGULATIONS OF NFPA 70 (NATIONAL ELECTRICAL CODE) AND 70E (STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE) WHERE SUCH REGULATIONS DO NOT CONFLICT WITH THOSE LAWS. CONTRACTOR SHALL OBTAIN ALL PERMITS AND COORDINATE ALL INSPECTIONS REQUIRED BY THE AUTHORITY HAVING JURISDICTION (AHJ).

STANDARD OF MATERIALS AND WORKMANSHIP:

ALL MATERIALS, EQUIPMENT AND APPARATUS COVERED BY THIS SPECIFICATION SHALL BE NEW, OF CURRENT MANUFACTURER AND SHALL BEAR THE SEAL OF APPROVAL OF THE UNDERWRITERS' LABORATORIES (UL LISTED). NEW EQUIPMENT SHALL BE CLEARLY LABELED WITH THE MANUFACTURER'S NAMEPLATE DATA.

ALL WORK SHALL BE EXECUTED IN A WORKMANLIKE MANNER AND SHALL PRESENT A NEAT AND CLEAN APPEARANCE WHEN COMPLETED. COVERS SHALL BE INSTALLED AND TIGHTLY FASTENED ON ALL ELECTRICAL ENCLOSURES. THE ENCLOSURES SHALL BE FREE OF DEBRIS AND LOOSE HARDWARE ON THE INTERIOR AND EXTERIOR. ALL ENCLOSURES SHALL BE CLEARLY IDENTIFIED ON THE EXTERIOR WITH PROPER NOMENCLATURE AND EXPECTED ARC FLASH LEVELS.

MAIN DISTRIBUTION AND BRANCH PANELBOARDS:

DISTRIBUTION PANELBOARDS AND BRANCH CIRCUIT PANELBOARDS SHALL BE PROVIDED WITH FULLY RATED COPPER BUSES. PANELBOARDS MAY BE MAIN LUG (MLO) OR MAIN CIRCUIT BREAKER (MCB) BUS CONFIGURATIONS. MAIN BUSES SHALL BE RATED NOT LESS THAN THE CAPACITY OF THE FEEDER CONDUCTORS SERVING THE PANEL.

PANELBOARDS SHALL BE PROVIDED WITH THE PROPERLY SIZED MAIN AND BRANCH CIRCUIT BREAKERS IN ACCORDANCE WITH THE APPROVED DESIGN DRAWINGS OR SCHEDULE A. UNUSED OPENINGS FOR CIRCUIT BREAKERS SHALL BE COVERED BY APPROVED BLANK COVER TO PREVENT EXPOSURE TO ENERGIZED PARTS WHEN THE PANEL COVER IS OPEN.

PANELBOARDS SHALL HAVE A SEPARATE EQUIPMENT GROUND TERMINAL BUS BONDED TO THE PANELBOARD ENCLOSURE SEPARATE FROM THE PANELBOARD NEUTRAL BUS (APPLICABLE TO 4-WIRE PANELS ONLY).

INTERRUPTING RATINGS SHALL BE COORDINATED WITH THE AVAILABLE SHORT CIRCUIT CURRENT.

LOADS SHALL BE CONNECTED TO PANELBOARD PHASES TO BALANCE THE PHASE CURRENTS WITHIN 10% MAXIMUM UNBALANCED LOADS.

NEW AND EXISTING PANELBOARDS ARE NOT PERMITTED TO BE USED AS A RACEWAY FOR CONDUCTORS NOT TERMINATED IN THE RESPECTIVE PANELBOARD.

PANELBOARDS INTENDED FOR SERVICE ENTRANCE USE SHALL BE LISTED, IDENTIFIED AND RATED FOR SERVICE ENTRANCE AND BE PROVIDED WITH A BONDING JUMPER TO CONNECT THE GROUNDED SERVICE CONDUCTOR TO THE PANELBOARD FRAME.

PANELBOARDS INSTALLED INDOORS SHALL BE MOUNTED IN NEMA 1 RATED ENCLOSURES AND PANELBOARDS INSTALLED OUTDOORS SHALL BE MOUNTED IN NEMA 3R RATED ENCLOSURES.

CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE PROVIDING TOP OR BOTTOM FED PANELBOARDS WITH SITE CONDITIONS AND THE APPROVED DESIGN DRAWINGS.

PANELBOARDS SHALL BE SECURELY MOUNTED AND LEVEL AT AN ACCEPTABLE HEIGHT ON A FIXED WALL OR UNISTRUT STRUCTURE. PANELBOARDS SHALL BE LOCATED TO MEET THE REQUIRED CLEARANCES AND DEDICATED SPACE REQUIRED BY NFPA 70.

ACCEPTABLE MANUFACTURER'S: EATON CUTLER HAMMER, GENERAL ELECTRIC, SQUARE D, SIEMENS AND OTHER MANUFACTURER'S APPROVED BY OWNER.

LOW VOLTAGE DRY TYPE TRANSFORMERS:

DRY TYPE TRANSFORMERS LESS THAN 300kVA SHALL HAVE COPPER WINDINGS. TRANSFORMERS GREATER THAN 300kVA MAY BE CONSTRUCTED WITH ALUMINUM WINDINGS UPON WRITTEN APPROVAL OF ELECTRICAL ENGINEER.

TRANSFORMERS SHALL MEET OR EXCEED DOE CANDIDATE STANDARD LEVEL 3 (CSL-3) AND BE LABELED NEMA-TP-3 FOR ENERGY EFFICIENCY.

TRANSFORMERS SHALL BE APPROPRIATELY SIZED TO OPERATE AS CLOSE TO MAXIMUM DESIGN CAPACITY.

PROVIDE TRANSFORMERS WITH 150 DEG C RISE UNLESS OTHERWISE NOTED ON DRAWINGS OR IN SCHEDULE A.

TRANSFORMERS SHALL BE PROVIDED +/-2 ½% TAPS.

CONTRACTOR SHALL FIELD VERIFY APPROPRIATE COOLING IS AVAILABLE FOR TRANSFORMERS INSTALLED IN ELECTRICAL CLOSETS OR VAULTS. PROVIDE ADDITIONAL COOLING MEANS AS REQUIRED FOR INSTALLATION.

CONTRACTOR SHALL FIELD VERIFY REQUIRED DELTA AND/OR WYE CONFIGURATIONS FOR EXISTING INSTALLATION PRIOR TO PURCHASING TRANSFORMERS.

HARMONIC MITIGATING AND/OR K-RATED TRANSFORMERS SHALL BE PROVIDED BASED ON RESULTS OF SYSTEM HARMONIC ANALYSIS PROVIDED BY SUBCONTRACTORS ENGINEERING CONSULTANT OR AS SPECIFIED IN APPROVED DESIGN DRAWINGS OR SCHEDULE A.

PANELBOARD MOUNTED BRANCH AND FEEDER CIRCUIT BREAKERS:

BRANCH AND FEEDER CIRCUIT BREAKERS SHALL BE APPROPRIATELY SIZED NO GREATER THAN TO THE CONDUCTORS THEY ARE PROTECTING. ALL CIRCUIT BREAKERS INSTALLED SHALL BE SELECTED BASED ON A LOAD CALCULATION AND FROM THE NEXT SIZE STANDARD AMPERE RATING PER NFPA 70.

CIRCUIT BREAKERS SHALL BE FULLY RATED AND SHALL HAVE AN A.I.C. RATING EQUAL TO THAT OF THE PANEL IN WHICH THEY ARE INSTALLED.

2-POLE AND 3-POLE CIRCUIT BREAKERS SHALL BE A SINGLE ASSEMBLY MANUFACTURED AND LISTED FOR MULTI-POLE USE. SINGLE POLE CIRCUIT BREAKERS ARE NOT PERMITTED TO BE GANGED TOGETHER TO FORM A MULTI-POLE CIRCUIT BREAKER.

CIRCUIT BREAKERS SHALL BE UL LISTED IN THE PANEL ASSEMBLY TO BE INSTALLED. BREAKERS MAY BE BOLT-ON OR SNAP-IN TYPE DEPENDING ON THE PANELBOARD CONFIGURATION.

ADJUSTABLE TRIP CIRCUIT BREAKERS SHALL BE PROVIDED WITH PROPERLY SIZED RATING TRIP PLUG.

CIRCUIT BREAKERS WITH ADJUSTIBLE INSTANTANEOUS, LONG, SHORT AND GROUND PICKUP SETTINGS SHALL BE ADJUSTED ACCORDING TO THE CURRENT COORDINATION STUDY.

CIRCUIT BREAKERS INSTALLED IN EXISTING PANELS:

CIRCUIT BREAKERS SHALL BE FIELD VERIFIED TO BE FULLY RATED AND SHALL HAVE AN A.I.C. RATING EQUAL TO THAT OF THE PANEL IN WHICH THEY ARE INSTALLED. SERIES RATED CIRCUIT BREAKERS MAY BE SUBMITTED TO ELECTRICAL ENGINEER ON A CASE BY CASE BASIS.

A LOAD ANALYSIS OF THE RESPECTIVE PANELBOARD SHALL BE PROVIDED TO THE CONTRACTOR WHEN ADDING ADDITIONAL CIRCUITS TO AN EXISTING PANELBOARD.

CONTRACTOR SHALL PROVIDE NEW OR UPDATE THE EXISTING PANELBOARD SCHEDULE WHEN ADDING NEW CIRCUITS TO AN EXISTING PANELBOARD.

SAFETY DISCONNECT SWITCHES:

SAFETY DISCONNECT SWITCHES SHALL BE TYPE "HD" (HEAVY DUTY) AND MAY BE FUSIBLE OR NON-FUSIBLE. FUSE SIZE AND NUMBER OF POLES SHALL BE COORDINATED WITH THE APPROVED DESIGN DRAWINGS OR SCHEDULE A.

DISCONNECTS MAY BE FACTORY MOUNTED OR FIELD INSTALLED. CONTRACTOR SHALL BE RESPONSIBLE FOR REVIEWING APPROVED EQUIPMENT CUTSHEETS TO DETERMINE THE NEED TO PROVIDE ADDITIONAL DISCONNECT SWITCHES.

SAFETY DISCONNECT SWITCHES SHALL BE INSTALLED WITHIN LINE OF SIGHT OF THE RESPECTIVE MOTOR LOAD. THE SAFETY DISCONNECT SHALL BE LOCKABLE IN THE DEENERGIZED STATE IF SITE CONDITIONS PREVENT THE DISCONNECT FROM BEING INSTALLED WITHIN LINE OF SIGHT OF THE LOAD.

SAFETY DISCONNECT SWITCHES INSTALLED INDOORS SHALL BE NEMA 1 RATED ENCLOSURES AND SAFETY DISCONNECTS SWITCHES MOUNTED OUTDOORS SHALL BE NEMA 3R RATED ENCLOSURES.

GROUNDING:

NON-METALLIC CONDUITS OR DUCTS SHALL CONTAIN AN EQUIPMENT GROUNDING CONDUCTOR UNLESS OTHERWISE SPECIFIED.

INSULATED GROUNDING BUSHINGS SHALL BE REQUIRED FOR ALL RACEWAYS ENTERING SERVICE ENTRANCE PANELS, DISTRIBUTION PANELS, ALL RACEWAYS WITH CONDUCTORS #4AWG OR LARGER AND ANY RACEWAY ENTERING A CONCENTRIC KNOCK-OUT.

AN EQUIPMENT GROUND WIRE SHALL BE INSTALLED IN EVERY RACEWAY. A METALLIC RACEWAY INSTALLATION ITSELF SHALL SERVE AS AN ADDITIONAL GROUNDING MEANS. METALLIC RACEWAYS ALONE ARE NOT TO BE CONSIDERED THE PRIMARY EQUIPMENT GROUND PATH AND WILL NOT BE ACCEPTABLE WITHOUT WRITTEN APPROVAL OF THE ELECTRICAL ENGINEER.

GROUNDING ELECTRODES SHALL BE COPPER 3/4" DIAMETER BY 10'-0" LONG WITH A RESISTANCE OF 25 OHMS OR LESS TO EARTH. ADDITIONAL GROUND ELECTRODES SHALL BE INSTALLED TO REDUCE THE RESISTANCE TO EARTH BELOW 25 OHMS. WHERE MULTIPLE GROUND DRIVEN ELECTRODES ARE REQUIRED THE SPACING SHALL BE A LEAST 6'-0" APART.

GROUND CONNECTIONS TO METAL UNDERGROUND WATER PIPE SHALL BE MADE WITHIN 5'-0" OF THE PIPE ENTRANCE TO THE BUILDING.

GROUND ELECTRODE CONDUCTORS AND EQUIPMENT GROUND CONDUCTORS SHALL BE COPPER AND SIZED IN ACCORDANCE WITH ARTICLE 250 OF NFPA 70.

CONDUCTORS:

ALL 600V CONDUCTORS SHALL BE COPPER (NOT LESS THAN 98% CONDUCTIVITY). CONDUCTOR TYPES MAY BE THHN/THWN OR XHHW WITH 600V INSULATION.

CONDUCTORS #12AWG THROUGH #10AWG MAY BE SOLID OR STRANDED, AND #8AWG AND LARGER SHALL BE STRANDED. NO CONDUCTORS SMALLER THAN #12AWG SHALL BE USED EXCEPT AS OTHERWISE NOTED. CONDUCTORS FOR CONTROL WIRING SHALL BE #14AWG MINIMUM.

MEDIUM VOLTAGE CONDUCTORS (2.4kV AND UP) SHALL BE SINGLE CONDUCTOR, COMPACT STRANDED COPPER, TYPE MV-105, 133% EPR INSULATION AND SHIELDED.

ALUMINUM CONDUCTORS WILL NOT BE ACCEPTED.

EXISTING CONDUCTORS MAY BE REUSED, AND/OR SPLICED AND EXTENDED PROVIDED THE INSULATION HAS PASSED A MEGGER TEST IN ACCORDANCE WITH NFPA 70B (RECOMMENDED PRACTICE FOR ELECTRICAL EQUIPMENT MAINTENANCE), AND PROVEN TO BE FREE OF DEFECTS AND INSULATION BREAKDOWN.

CONDUCTOR SPLICES AND TAPS:

SPLICES AND TAPS SHALL BE MADE IN AN ACCESSIBLE JUNCTION BOX, PULLBOX, WIRE TROUGH OR PANELBOARD ENCLOSURE.

THE MATERIALS SHALL BE COMPATIBLE WITH THE CONDUCTIVE MATERIAL, INSULATION AND PROTECTIVE JACKETS OF THE CONDUCTORS BEING SPLICED OR TAPPED AND LISTED FOR THE USE.

ALUMINUM AND ALUMINUM ALLOY FITTINGS WILL NOT BE ACCEPTED.

LISTED CU/AL CONNECTORS OR TERMINAL LUGS SHALL BE USED WHEN SPLICING OR TAPPING NEW COPPER CONDUCTORS WITH EXISTING ALUMINUM CONDUCTORS TO REMAIN INSTALLED.

FOR 600V CONDUCTOR SIZES #6 AWG AND LARGER: SPLICES IN CONDUCTORS SHALL BE MADE WITH INDENTER, CRIMP CONNECTORS AND COMPRESSION TOOLS OR WITH BOLTED CLAMP TYPE CONNECTORS TO INSURE A SATISFACTORY MECHANICAL AND ELECTRICAL JOINT.

RACEWAYS AND FITTINGS:

CONDUIT RACEWAYS SHALL BE INSTALLED AS INDICATED HEREIN. WHERE MORE THAN ONE TYPE OF RACEWAY IS LISTED UNDER ONE CONDITION, THE CONTRACTOR MAY EXERCISE HIS OPTION OF THE RACEWAY USED. CONDITIONS OF RACEWAY INSTALLATION ARE AS FOLLOWS:

ALL RACEWAYS SHALL BE UL LISTED. FITTINGS AND CONNECTORS SHALL BE MADE FROM THE SAME MATERIAL AS THE CONDUIT TO BE INSTALLED.

RACEWAYS LESS THAN 3/4" SHALL NOT BE USED.

RIGID METALLIC CONDUIT (RMC) SHALL BE INSTALLED IN EXPOSED LOCATIONS WHERE INSTALLED BELOW 8'-0", WHERE THE CONDUIT MAY POSSIBLY BE DAMAGED, EXPOSED TO MOISTURE OR INSTALLED OUTDOORS.

ELECTRICAL METALLIC CONDUIT (EMT) MAY BE INSTALLED IN INDOOR APPLICATIONS EITHER EXPOSED OR CONCEALED IN WALLS AND ABOVE CEILINGS.

RIGID NONMETALLIC CONDUIT (RNC) MAY BE INSTALLED IN UNDERGROUND APPLICATIONS. UNDERGROUND CONDUIT SHALL BE SCHEDULE 40 PVC AT A MINIMUM. RACEWAYS CONCEALED UNDERGROUND OUTSIDE BUILDING SHALL BE A MINIMUM OF 2 FEET BELOW GRADE. RMC ELBOWS SHALL BE UTILIZED TO TRANSITION FROM PVC UP THROUGH CONCRETE SLABS. UNDERGROUND CONDUIT MAY BE DIRECT BURIED OR PROVIDED IN CONCRETE DUCTBANK AS OUTLINED IN SCHEDULE A OR APPROVED DESIGN DRAWINGS.

FLEXIBLE METAL CONDUIT (FMC) MAY BE INSTALLED AS THE FINAL RACEWAY CONNECTION TO VIBRATING EQUIPMENT (I.E. PUMPS, MOTORS AND TRANSFORMERS). FLEXIBLE CONDUITS SHALL NOT EXCEED 6FT IN LENGTH. FLEXIBLE CONDUIT IN ALL AREAS SUBJECT TO MOISTURE SHALL BE LIQUID-TIGHT METAL FLEXIBLE CONDUIT (LFMC).

EXISTING CONDUITS MAY BE REUSED TO FULLEST EXTENT POSSIBLE PROVIDED THEY ARE NOT DAMAGED FROM PREVIOUS DEMOLITION AND ARE APPROPRIATELY SIZED FOR THE CONDUCTOR FILL.

NO MORE THAN THREE CURRENT CARRYING CONDUCTORS MAY BE INSTALLED IN ANY ONE CONDUIT UNLESS THE CONDUCTOR RATINGS ARE DERATED PER THE NEC. A SEPARATE NEUTRAL SHALL BE PROVIDED TO EACH CIRCUIT.

RACEWAYS SHALL BE RUN PARALLEL WITH OR AT RIGHT ANGLES TO THE BUILDING JOISTS AND WALLS AND SHALL BE SECURELY SUPPORTED VERTICALLY AND HORIZONTALLY WITH APPROVED WIRING SUPPORT METHODS (I.E. CLAMPS, HANGERS, BUSHINGS, TIE-WRAP).

ALL ABANDONED AND EMPTY CONDUITS SHALL BE PROVIDED WITH A PLASTIC OR NYLON FISH WIRE AND SHALL BE LABELED AT EACH END.

RACEWAYS SHALL BE KEPT AT LEAST 12" INCHES FROM PARALLEL RUNS OF FLUES, STEAM PIPES OR HOT WATER LINES.

FITTINGS AND CONNECTORS FOR RMC AND EMT SHALL BE STEEL SET SCREW OR COMPRESSION TYPE. DIE CAST FITTINGS OR CONNECTORS WILL NOT BE ACCEPTABLE.

ALL RACEWAYS ENTERING A BUILDING SHALL BE WEATHERPROOF SEALED TO PREVENT THE ENTRANCE OF MOISTURE.

ALL RACEWAY PENETRATIONS INSTALLED THROUGH FIRE-RESISTANT-RATED WALLS, PARTITIONS, CEILINGS AND FLOORS SHALL BE FIRESTOPPED USING APPROVED METHODS TO MAINTAIN FIREPROOF INTEGRITY.

ELECTRICAL BOXES:

ALL JUNCTION BOXES, WIRE TROUGHS AND PULL BOXES SHALL BE SIZED PER NFPA 70. REQUIREMENTS AND BE OF THE PROPER NEMA CLASSIFICATION FOR THE LOCATIONS

WHERE THEY ARE INSTALLED. COVERS SHALL BE INSTALLED ON ALL ELECTRICAL BOXES. COVERS SHALL BE LABELD WITH CIRCUIT DESIGNATION IN PERMANT MARKER OR ADHESIVE NAMEPLATE.

SWITCH AND RECEPTACLE OUTLET BOXES SHALL BE 4" SQUARE OR 4-11/16" AND A MINIMUM OF 1-1/2" DEEP WITH SWITCH RING AS REQUIRED OR GANG BOXES A MINIMUM OF 2" DEEP WHEN MORE THAN TWO DEVICES MOUNT UNDER A COMMON COVER.

MISCELLANEOUS ELECTRICAL WORK:

CONTRACTOR SHALL PROVIDE ADDITIONAL GENERAL PURPOSE RECEPTACLES FOR SERVICING MECHANICAL EQUIPMENT INSTALLED UNDER THIS CONTRACT (I.E. NEAR ROOFTOP UNITS AND CONDENSING UNITS).

ADDITIONAL GFCI RECPTACLES SHALL BE PROVIDED IN LOCATIONS OUTLINED PER NFPA 70 FOR RENOVATIONS OF MECHANICAL ROOMS.

MECHANICAL ROOM LIGHT FIXTURES HINDERING AN INSTALLATION SHALL BE DISCONNECTED AND REMOVED DURING CONSTRUCTION TO FACILITATE DEMOLITION AND/OR INSTALLATION OF MECHANICAL EQUIPMENT, PIPING AND DUCTWORK. CONTRACTOR SHALL REINSTALL LIGHT FIXTURES WHEN EQUIPMENT INSTALLATION IS COMPLETE. LIGHT LEVELS SHALL MEET IESNA RECOMMENDED LEVELS UPON COMPLETION OF WORK.

EQUIPMENT LABELS AND IDENTIFICATION:

ALL SWITCHBOARDS, PANELBOARDS, MOTOR CONTROL CENTERS AND INDUSTRIAL CONTROL PANELS INSTALLED UNDER THIS CONTRACT AND REQUIRING SERVICING, INSPECTION AND MAINTENANCE WHILE ENERGIZED SHALL BE CLEARLY MARKED WITH PERMANENT ARC FLASH HAZARD WARNING LABELS. LABELS SHALL INCLUDE PPE REQUIREMENT AND REFERENCE TO NFPA 70E.

EQUIPMENT IDENTIFICATION SHALL BE MADE USING ENGRAVED LAMINATED PHENOLIC OR MICARTA PLATES (INDENTED TAPE LABELS WILL NOT BE PERMITTED). CHARACTERS SHALL BE WHITE ON A BLACK BACKGROUND AND 1/4" HIGH MINIMUM. PLATES SHALL BE SECURED TO THE PANELS BY MEANS OF SCREWS OR METAL PRESSURE PINS. CEMENT, BY ITSELF, WILL NOT BE ACCEPTABLE. ALL NAMEPLATES SHALL BE MOUNTED ON THE OUTSIDE SURFACE OF THE PIECE OF EQUIPMENT. INDIVIDUALLY ENCLOSED SAFETY SWITCHES, CIRCUIT BREAKERS, AND MOTOR STARTERS, PULL BOXES, CONTROL CABINETS AND OTHER SUCH ITEMS SHALL BE IDENTIFIED INDICATING LOAD, ELECTRICAL CHARACTERISTICS, AND SOURCE.

CONDUCTORS SHALL BE COLOR CODED OR PROVIDED WITH COLOR CODED ELECTRICAL TAPE MARKINGS TO IDENTIFY THE VOLTAGE LEVELS AND PHASES AS FOLLOWS (UNLESS THE SITE HAS PREVIOUSLY ESTABLISHED A COLOR CODE CONVENTION):

480Y/277V SYSTEMS:
 PHASE A – BROWN
 PHASE B – ORANGE
 PHASE C – YELLOW
 NEUTRAL – GREY

208Y/120V SYSTEMS:
 PHASE A – BLACK
 PHASE A – RED
 PHASE A – BLUE
 NEUTRAL – WHITE

ALL RACEWAYS LEAVING THE PANELBOARD ENCLOSURES SHALL BE CLEARLY MARKED WITH THEIR RESPECTIVE CIRCUIT NUMBERS. FOR EXAMPLE, A CONDUIT CONTAINING CONDUCTORS FOR PANEL MDP, CIRCUIT NO. 5 WOULD BE MARKED MDP-5. EMPTY CONDUITS SHALL BE MARKED "EMPTY".

ANALYSIS AND TESTING:

THE FOLLOWING ELECTRICAL ANALYSIS AND/OR STUDY MUST BE PROVIDED BY A REGISTERED PROFESSIONAL ENGINEER:

- ARC FLASH STUDY
- COORDINATION STUDY
- LOAD ANALYSIS
- AVAILABLE SHORT-CIRCUIT ANALYSIS

AT THE COMPLETION OF THE WORK, A THOROUGH TEST SHALL BE MADE IN THE PRESENCE OF OWNER, AND THE ENTIRE SYSTEM SHALL BE SHOWN TO BE IN PERFECT WORKING CONDITION AS INTENDED BY THESE SPECIFICATIONS. CONTRACTOR SHALL PROVIDE FULL ANALYSIS AND TEST REPORTS REQUIRED IN THESE SPECIFICATIONS AND THE COMMISSIONING PLAN.

GUARANTEE:

THE CONTRACTOR SHALL LEAVE THE ENTIRE ELECTRICAL SYSTEM INSTALLED UNDER THIS CONTRACT IN PROPER WORKING ORDER AND SHALL REPLACE, WITHOUT ADDITIONAL CHARGE, ALL WORK OR MATERIAL WHICH MAY DEVELOP DEFECTS, ORDINARY WEAR AND TEAR OR DAMAGE RESULTING FROM IMPROPER HANDLING EXCEPTED, WITHIN A PERIOD OF ONE YEAR FROM THE DATE OF INITIAL TESTING AND ACCEPTANCE BY THE CONTRACTOR.