1.0 BASIC ELECTRICAL REQUIREMENTS

1.1 SCOPE OF WORK
- A. FOR PURPOSE OF LEGIBILITY, DRAWINGS ARE DIAGRAMMATIC AND ALTHOUGH LOCATION OF EQUIPMENT IS SHOWN TO SCALE, THE CONTRACTOR SHALL VERIFY ALL INFORMATION AT THE SITE BEFORE BIDDING THE JOB.
- B. WHEN DRAWINGS, NOTES AND THESE REQUIREMENTS ARE IN CONFLICT, THE MOST STRINGENT CONDITION SHALL APPLY UNLESS OTHERWISE APPROVED BY THE ENGINEER.
- C. THE WORK CONSISTS OF ALL SUPERVISION, LABOR, MATERIALS, EQUIPMENT AND INSTALLATION REQUIRED FOR THE COMPLETE ELECTRICAL SYSTEMS AS SHOWN ON THE DRAWINGS OR CALLED FOR IN THESE REQUIREMENTS.
- D. FURNISH, INSTALL AND MAINTAIN TEMPORARY ELECTRICAL POWER AND LIGHTING REQUIRED FOR ALL TRADES.
- E. CONNECT ELECTRICAL EQUIPMENT FURNISHED BY OTHER TRADES EVEN IF NOT SHOWN ON ELECTRICAL DRAWINGS.

1.2 CODES AND STANDARDS
PERFORM WORK AND FURNISH EQUIPMENT COMPLYING WITH THE FOLLOWING CODES:
1) NATIONAL ELECTRICAL CODE (NEC)
2) NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
3) UNDERWRITERS' LABORATORIES (UL)
4) NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
5) AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
6) INSULATED POWER CABLE ENGINEERS ASSOCIATION (IPCEA)
7) FLORIDA BUILDING CODE (FBC)
8) INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

1.3 SHOP DRAWINGS
WITHIN 30 DAYS AFTER THE DATE OF THE AWARD OF THE CONTRACT, AND BEFORE ANY MATERIAL OR EQUIPMENT IS PURCHASED, SUBMIT TO THE ENGINEER FOR APPROVAL, A COMPLETE LIST IN QUINTUPLICATE OF ELECTRICAL MATERIALS, AND EQUIPMENT TO BE INCORPORATED IN THE WORK. INCLUDE CATALOG NUMBER, DIMENSIONS, INTERCONNECTION DIAGRAMS AND INSTALLATION INSTRUCTIONS.

1.4 OPERATION AND MAINTENANCE MANUALS
O & M MAINTENANCE MANUALS MUST CONTAIN BUT NOT LIMITED TO THE FOLLOWING:
1) SYSTEM DESCRIPTION, AND OPERATING AND MAINTENANCE INSTRUCTIONS.
2) MANUFACTURER'S NAME AND MODEL NUMBER OF ALL COMPONENTS.
3) CONTROL AND WIRING DIAGRAMS WITH SEQUENCE OF OPERATION.
4) LIST OF RECOMMENDED SPARE PARTS.

1.5 AS BUILT DRAWINGS
AFTER FINAL INSPECTION, FURNISH A SET OF REPRODUCIBLE "AS BUILT DRAWINGS" SHOWING DEPTHS AND ROUTING OF CONCEALED ELECTRICAL BELOW GRADE INSTALLATIONS AND ALL VARIATIONS BETWEEN THE ACTUAL WORK AND AS IT WAS SHOWN ON THE CONTRACT DRAWINGS.

1.6 MATERIALS
A. FURNISH EQUIPMENT AND MATERIALS THAT ARE NEW AND LATEST DESIGN OF STANDARD PRODUCTS OF MANUFACTURERS REGULARLY ENGAGED IN THE PRODUCTION OF SUCH EQUIPMENT.
B. ALL MATERIALS SHALL BEAR THE LABEL OF UNDERWRITER'S LABORATORY FOR THE INTENDED USE.
C. EQUIPMENT ENCLOSURES SHALL BE NEMA 12 FOR INDOOR USE, AND NEMA 4X (STAINLESS STEEL) OR 3R AS SHOWN ON DRAWINGS FOR OUTDOOR USE.
D. FURNISH LIGHTING FIXTURES WITH LAMPS AND 10 PERCENT (TWO MINIMUM) SPARE LAMPS OF EACH TYPE.
E. FURNISH FUSIBLE EQUIPMENT WITH FUSES AND 10 PERCENT (THREE MINIMUM) OF SPARE FUSES OF EACH TYPE.

1.7 INSTALLATION
- A. INSTALL EQUIPMENT AT THE LOCATIONS SHOWN ON THE DRAWINGS FOLLOWING THE MANUFACTURER'S RECOMMENDATIONS.
- B. COORDINATE INSTALLATION OF UNDERGROUND DUCTS AND CONDUITS WITH EXISTING UNDERGROUND UTILITIES. FIELD VERIFY ROUTING AND BURIAL DEPTH. DRAIN DUCTS AWAY FROM BUILDINGS TOWARD MANHOLES. LOW POINTS IN DUCT BANK RUNS ARE NOT ACCEPTABLE.
- C. INSTALL FLOOR MOUNTED SELF SUPPORTED EQUIPMENT ON 4-INCHES HIGH CONCRETE PADS WITH STEEL REINFORCING. USE REQUIRED BOLTS, ANCHORS, INSERTS AND CONDUIT SLEEVES.
- D. MAKE OPENINGS THROUGH WALLS, CEILINGS, ROADWAYS, FLOOR SLABS, ETC. REQUIRED FOR THE INSTALLATION OF ELECTRICAL EQUIPMENT, BUT CUTTING, WELDING, OR OTHER WEAKENING OF BUILDING STRUCTURE TO SIMPLIFY ELECTRICAL EQUIPMENT AND MATERIALS' INSTALLATION ARE NOT BE PERMITTED. WHERE EXISTING WALLS, CEILINGS OR FLOOR SLABS HAVE TO BE CUT, THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER BEFORE MAKING SUCH CUTS. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY DAMAGE DONE WHILE PROVIDING SUCH OPENINGS AND SHALL PATCH THE SURFACE TO MATCH ADJACENT MATERIALS AND FINISHES.
- E. NO CONDUITS, SLEEVES, PIPES OR ANY OTHER ITEM SHALL BE EMBEDDED IN CONCRETE ALONG OR THROUGH ANY BEAM, COLUMN, FOOTING, GRADE BEAM, SLAB, WALL OR ANY OTHER STRUCTURAL MEMBER WITHOUT THE PRIOR APPROVAL OF THE ENGINEER.
- F. COORDINATE SHIPPING LENGTHS OF SWITCH GEARS AND MOTOR CONTROL CENTERS. THOSE ITEMS SHALL BE ABLE TO BE REMOVED AND REPLACED IN THE FUTURE THROUGH THE PERMANENT ACCESS PROVIDED IN THE STRUCTURE.
- G. PROVIDE 36- INCHES WIDE, 3/16- INCHES THICK RUBBER MATS IN THE FRONT AND REAR OF SWITCH GEARS, MOTOR CONTROL CENTERS AND SWITCHBOARDS. MATS TO COMPLY WITH FEDERAL SPECS ZZ-F-416A.

1.8 TESTING
UPON COMPLETION OF THE WORK, THE CONTRACTOR SHALL ENERGIZE, START-UP AND TEST OPERATE ALL THE SYSTEMS AND EQUIPMENT IN THE PRESENCE OF THE ENGINEER. INSULATION RESISTANCE TESTS SHALL BE MADE ON EACH 480 AND 240 VOLT FEEDER WITH A 500 VOLT DC MEGGER. DEFECTS FOUND SHALL BE CORRECTED.

2.0 RACEWAYS

2.1 RIGID CONDUIT
- A. STEEL: HOT DIPPED ZINC COATED, GALVANIZED, THREADED RIGID STEEL CONFORMING TO ANSI C80, AND FED. SPEC WW-C-581. USE THREADED GALVANIZED STEEL FITTINGS.
- B. ALUMINUM: CONTAINING LESS THAN 0.1 PERCENT COPPER AND CONFORMING TO FEDERAL SPECIFICATION WW-C-540C. USE THREADED ALUMINUM FITTINGS.
- C. PLASTIC: RIGID, SCHEDULE 40, 90 DEGREES C., UL RATED, PVC PLASTIC CONFORMING TO UL 651, FED. SPEC. W-C-1094 AND NEMA TC-2. FITTINGS TO CONFORM WITH UL3 514 AND NEMA TC-3.

2.2 FLEXIBLE METAL CONDUIT
LIQUID-TIGHT: FLEXIBLE ZINC COATED CONFORMING TO UL 1 TYPE WITH LIQUID-TIGHT FLEXIBLE PLASTIC SHEATH, CONFORMING TO UL 360 STANDARD.
FITTINGS, PER FED. SPEC. W-R-406B AND UL 514.

2.3 LOCATION AND USE OF EACH TYPE OF CONDUIT
- A. USE RIGID ALUMINUM CONDUIT FOR ABOVE GROUND EXPOSED INSTALLATIONS EXCEPT IN CORROSIVE AREAS WHERE PVC COATED RIGID GALVANIZED STEEL SHALL BE USED.
- B. USE GALVANIZED THREADED RIGID STEEL CONDUIT AS FOLLOWS:
  1) WHEREVER SPECIFICALLY CALLED FOR ON DRAWINGS.
  2) WHERE RACEWAY ELBOWS FROM DUCT BANKS STUB-UP.
  3) FOR UNDERGROUND WORK BEYOND BUILDINGS WHERE CONCRETE ENCASED PLASTIC CONDUITS HAVE NOT BEEN SPECIFIED. COAT BURIED GALVANIZED STEEL CONDUITS AND FITTINGS WITH TWO COATS OF CARBOLINE'S BITUMASTIC NO. 50 OR EQUAL.
- C. USE PLASTIC CONDUIT AS FOLLOWS:
  1) WHEN INSTALLED IN POURED CONCRETE SLABS OR WALLS.
  2) FOR UNDERGROUND WORK UNDER SLABS.
  3) IN DUCT BANKS OR, IF SPECIFICALLY CALLED FOR, IN TRENCHES. BACK-FILL TRENCHES WITH STRUCTURAL FILL 90 % COMPACTED (PROCTOR DENSITY) AND RESOD TO ORIGINAL CONDITION.
- D. USE FLEXIBLE METAL CONDUIT (24 TO 60 INCHES LONG) FOR CONNECTIONS TO ROTATING OR VIBRATING EQUIPMENT.

2.4 INSTALLATION
- A. DRAWINGS ARE DIAGRAMMATIC AND DO NOT SHOW ALL BENDS, FITTINGS, BOXES, AND SPECIALTIES WHICH MAY BE REQUIRED OR THE EXACT LOCATION OF CONDUITS. EXAMINE THE STRUCTURAL AND FINISH CONDITIONS AFFECTING ALL OF THE WORK AND PLAN IT ACCORDINGLY, FURNISHING SUCH FITTINGS AS MAY BE REQUIRED TO MEET SUCH CONDITIONS. ARRANGE CONDUIT RUNS TO CLEAR BEAMS, PIPES AND OTHER OBSTRUCTIONS AND AVOID INTERFERENCES WITH OTHER TRADES WORK. ANY CHANGES FROM LOCATIONS SHOWN ON THE DRAWINGS MUST BE APPROVED BY THE ENGINEER.
- B. INSTALL RACEWAYS PARALLEL OR PERPENDICULAR TO WALLS, STRUCTURAL MEMBERS, OR INTERSECTIONS OF VERTICAL PLANES AND CEILINGS. INSTALL HORIZONTAL RACEWAYS CLOSE TO CEILING OR CEILING BEAMS, AND ABOVE PIPES AND DUCTS.
- C. SIZE RACEWAY ACCORDING TO NEC, BUT IN NO CASE SHALL BE LESS THAN INDICATED ON DRAWINGS. MINIMUM SIZE SHALL BE 3/4-INCH, EXCEPT FLEXIBLE CONDUITS TO LIGHT FIXTURES CAN BE 3/8" BUT NOT EXCEEDING SIX FEET LONG.
- D. INSTALL CONDUITS PASSING THROUGH WALLS AND SLABS IN PVC SLEEVES. EXTEND SLEEVES THROUGH FULL CONCRETE THICKNESS AND PROVIDE 1/2- INCH CLEARANCE AROUND CONDUITS TO FACILITATE SEALING.
- E. SEAL ANY OPENING MADE IN SLABS OR WALLS TO PREVENT SMOKE OR FIRE SPREAD AND THE PASSAGE OF WATER. USE SEALING COMPOUND APPROVED FOR THE PURPOSE.
- F. USE EXPANSION FITTINGS WHEN CONDUITS CROSS STRUCTURAL EXPANSION JOINTS.
- G. EXCEPT WHERE BOXES, PANELS AND OTHER EQUIPMENT HAVE THREADED OPENINGS, MAKE CONDUIT CONNECTIONS AS FOLLOWS:
  1) DOUBLE LOCKNUTS, ONE INSIDE AND ONE OUTSIDE.
  2) PROVIDE MALLEABLE, IRON OR STEEL BUSHING WITH BAKELITE LINER MOLDED AND BONDED INTO THE BUSHING.
  3) PLACE GROUNDING BUSHING ON END OF CONDUIT IN ADDITION TO LOCKNUTS.

2.5 SUPPORT OF RACEWAY
- A. INSTALL WALL MOUNTED ELECTRICAL EQUIPMENT, WIRING TROUGHS, JUNCTION BOXES AND GROUPS OF TWO OR MORE CONDUITS ON A SYSTEM OF EXTRUDED, GAUGE 12, 1-5/8 INCHES WIDE, ALUMINUM CHANNELS. ATTACH CHANNELS TO WALL WITH STAINLESS STEEL MACHINE BOLTS AND EXPANSION SHIELDS. CHANNELS TO BE SERIES P-1000 WITH COMPATIBLE HARDWARE AND FITTINGS AS MANUFACTURED BY UNISTRUT MFG. CO. OR EQUAL.
- B. FASTEN VERTICAL AND HORIZONTAL RUNS OF RACEWAYS AT INTERVALS OF NOT MORE THAN EIGHT FEET AND WITHIN 3 FEET OF BENDS, OUTLETS AND JUNCTION BOXES.
- C. SUPPORT SINGLE CONDUITS NOT LARGER THAN 1-1/2 INCHES IN DIAMETER BY MEANS OF TWO-HOLE PIPE STRAPS OR INDIVIDUAL PIPE HANGERS. FOR CONDUITS LARGER THAN 1-1/2 INCHES IN DIAMETER USE INDIVIDUAL PIPE HANGERS.
- D. SPACE CONDUITS INSTALLED AGAINST CONCRETE SURFACES NOT LESS THAN 1/4 INCH AWAY FROM THE SURFACES BY CLAMP BACKS OR OTHER APPROVED MEANS.
- E. FURNISH HANGER RODS MADE OF GALVANIZED STEEL OF NOT LESS THAN 1/4 INCH IN DIAMETER. WHEN CONCEALED ABOVE A SUSPENDED CEILING, GALVANIZED PERFORATED STEEL STRAPPING IS ACCEPTABLE.
- F. SUPPORT BRANCH CIRCUIT RACEWAYS INSTALLED ABOVE SUSPENDED CEILING INDEPENDENTLY OF THE CEILING SUPPORT SYSTEM. WHEREVER POSSIBLE, THEY SHALL BE FASTENED TO THE UNDERSIDE OF THE SLAB ABOVE.

3.0 CONDUCTORS (600 VOLTS)

3.1 MATERIAL
- A. FURNISH CONDUCTORS OF 98 % ANNEALED COPPER, 600 VOLT CLASS B, HEAT AND MOISTURE RESISTANT, THERMOPLASTIC TYPE THHN/THHW (SIZED BY THW RATING), WITH A POLYVINYL CHLORIDE INSULATION RESISTANT TO OIL, GASOLINE AND WEATHER. INSULATION SHALL MEET UL STANDARD 83.
- B. CONDUCTORS TO BE STRANDED; #8 THROUGH #2 SHALL BE 7 STRAND; #1 THROUGH 4/0, 19 STRAND AND 250 MCM THROUGH 500 MCM, 37 STRAND.

3.2 IDENTIFICATION
- A. COLOR CODE POWER CONDUCTORS AS FOLLOWS:
  1) 120/240 VOLT SYSTEM: WHITE-NEUTRAL, BLACK-PHASE A, BLUE-PHASE B, RED-PHASE C.
  2) 277/480 VOLT SYSTEM: GRAY-NEUTRAL, YELLOW-PHASE A, BROWN-PHASE B, ORANGE-PHASE C.
  3) BONDING CONDUCTOR GREEN.
- B. IDENTIFY FEEDERS, BRANCH CIRCUITS AND INSTRUMENTATION AND CONTROL WIRES AT TERMINATIONS, JUNCTION AND PULL BOXES.

3.3 INSTALLATION
- A. DO NOT USE CONDUCTORS SMALLER THAN AWG #12 FOR POWER AND #14 FOR CONTROL UNLESS SPECIFICALLY INDICATED ON DRAWINGS.
- B. DO NOT PULL CONDUCTORS INTO CONDUITS UNTIL THE MECHANICAL WORK HAS BEEN COMPLETED.
- C. GROUP AND TIE CONDUCTORS IN PANEL BOARDS, JUNCTION BOXES, PULL BOXES, ETC., FOR A NEAT AND ORDERLY APPEARANCE.
- D. USE CONNECTORS, TERMINALS AND SPLICES THAT ARE DESIGNED AND APPROVED FOR THE SPECIFIC TYPE AND SIZE OF THE CONDUCTORS BEING CONNECTED.
- E. FIREPROOF FEEDERS WHERE NOT PROTECTED BY CONDUITS LIKE IN MANHOLES, SWITCH GEARS, ETC.

4.0 OUTLET, PULL AND JUNCTION BOXES

- A. OUTLET BOXES IN INDOOR FINISHED WALLS TO BE GALVANIZED STEEL, 4" X 4" X 1-1/2" CONFORMING TO FEDERAL SPECIFICATIONS WC-583 AND ANSI-C33.65.
- B. EXTERIOR OUTLET BOXES, BOXES AND FITTINGS EMBEDDED IN CONCRETE, AND BOXES FOR EXPOSED CONDUIT RUNS SHALL BE CAST OF RUST RESISTING METAL, WITH FULL THREADED HUBS, AND SCREW TYPE RUBBER GASKET COVERS.
- C. INSTALL BOXES FOR LIGHT SWITCHES LOCATED NEAR DOORS ON THE LOCK SIDE, EVEN WHERE THE SYMBOLS ARE INDICATED ON THE HINGE SIDES.
- D. PULL AND JUNCTION BOXES SHALL BE OF 12 GAUGE WELDED ALUMINUM WITH HINGED COVER. NEMA 12 FOR INDOOR USE AND NEMA 4X FOR OUTDOOR USE. MINIMUM DIMENSIONS SHALL BE 12" X 12" X 6".
- E. IN CORROSIVE AREAS OR WHERE CALLED FOR ON DRAWINGS, FURNISH PULL AND JUNCTION BOXES OF 14 GAUGE STAINLESS STEEL.
- F. WHEN SPLICING CONTROL CONDUCTORS IN BOXES USE SCREW TYPE TERMINAL STRIP BLOCKS CLASS 9080 (G) AS MANUFACTURED BY SQUARE D OR EQUAL, IDENTIFY EVERY WIRE AT BOTH SIDES AND PROVIDE SPADE TYPE LUGS FOR TERMINATION.
- G. PROVIDE PULL AND JUNCTION BOXES WHERE REQUIRED TO REDUCE LENGTH OF CABLE PULL OR REDUCE NUMBER OF ELBOWS BETWEEN OUTLETS.

5.0 SWITCHES AND RECEPTACLES

- A. FURNISH WALL SWITCHES OF THE QUIET AND TOTALLY ENCLOSED TUMBLER TYPE, WITH BODIES OF PHENOLIC COMPOUND. WIRING TERMINALS SHALL BE OF THE SCREW TYPE. NO MORE THAN ONE SWITCH SHALL BE INSTALLED IN A SINGLE-GANG POSITION. SWITCHES SHALL CONFORM TO FEDERAL SPECIFICATIONS WS-5896E, HUBBEL 1221 AND 1223, OR APPROVED EQUAL.
- B. USE 20A, 125 V, DUPLEX, U-SLOTTED, GROUNDING TYPE RECEPTACLES THAT CONFORM TO FEDERAL SPECIFICATIONS WC-596D, HUBBEL 5362, OR EQUAL.
- C. AMOUNT DUPLEX RECEPTACLES VERTICALLY. BOXES MOUNTED BACK TO BACK ARE NOT BE PERMITTED. GANGED RECEPTACLES AND SWITCHES SHALL HAVE SINGLE MULTI-GANG COVER PLATE.
- D. FURNISH HOSPITAL GRADE GROUND FAULT INTERRUPTER WITH DIFFERENTIAL CURRENT TRANSFORMER, SOLID STATE SENSING CIRCUITRY AND CIRCUIT INTERRUPTER. SENSITIVITY TO BE 5 MA, TRIPPING TIME 1/30TH OF A SECOND.
- E. WHEN INSTALLING RECEPTACLES IN OUTDOOR LOCATIONS USE CAST-METAL OUTLET BOXES WITH GASKET WEATHERPROOF CAST-METAL COVER PLATES AND SPRING-FLAP CAP OVER EACH RECEPTACLE.
- F. USE STAINLESS STEEL COVER PLATES FOR SWITCHES AND RECEPTACLES EXCEPT IN NON-INDUSTRIAL AREAS SUCH AS OFFICES, REST ROOMS, LABORATORIES, ETC.

6.0 MOTOR DISCONNECT SWITCHES & STARTERS

- A. PROVIDE EACH MOTOR WITH A DISCONNECTING MEANS MEETING THE REQUIREMENTS OF N.E.C. ARTICLE 430. SWITCHES SHALL BE HEAVY DUTY, HORSE POWER RATED, SUITABLE TO BE PADLOCKED IN "OFF" POSITION AND CONFORM TO FEDERAL SPECS W-S-865, NEMA KS1 AND ANSI C33.64. IF FUSES ARE REQUIRED, THEY SHALL BE CURRENT LIMITING TYPE
- B. SIZE DISCONNECTS AND STARTERS FOR THE FULL LOAD OF THE CONTROLLED MOTOR. THE HORSEPOWER RATINGS INDICATED ON THE DRAWINGS ARE SHOWN FOR THE BENEFIT OF THE CONTRACTOR AND DO NOT LIMIT EQUIPMENT SIZE.
- C. FOR SINGLE-PHASE FRACTIONAL HORSEPOWER MOTORS, A SINGLE OR DOUBLE-POLE TOGGLE SWITCH WILL BE ACCEPTABLE PROVIDED THE AMPERE RATING OF THE SWITCH IS AT LEAST 125 PERCENT OF MOTOR RATING.
- D. SWITCHES SHALL BE THE QUICK-BREAK TYPE AND DISCONNECT ALL UNGROUNDED CONDUCTORS.
- E. FOR MOTORS LARGER THAN 1/4 HORSEPOWER, FURNISH STARTERS SPECIFICALLY DESIGNED FOR THE PURPOSE AND HAVING A HORSEPOWER RATING EQUAL TO THE MOTOR CONTROLLED.
- F. PROVIDE MOTORS OF 1/8 HORSEPOWER OR LARGER WITH THERMAL-OVERLOAD PROTECTION. THE OVERLOAD PROTECTION DEVICE, OF THE MANUAL RESET TYPE AND WITH CONTACTS ON EACH PHASE, SHALL BE PART OF THE STARTER. SIZE THE OVERLOAD HEATER ELEMENTS ACCORDING TO THE MOTOR MANUFACTURER'S RECOMMENDATIONS AND BASED ON THE ACTUAL MOTOR NAMEPLATE FULL-LOAD CURRENT.
- G. PROVIDE EACH MOTOR WITH A SUITABLE CONTROLLER OR DEVICE TO MAKE IT PERFORM AS REQUIRED. AUTOMATIC CONTROL DEVICES SUCH AS THERMOSTATS, FLOAT OR PRESSURE SWITCHES MAY DIRECTLY CONTROL THE START-STOP OF MOTORS UP TO 1/4 HORSEPOWER, PROVIDED THE DEVICES USED ARE DESIGNED FOR THE PURPOSE AND HAVE AN ADEQUATE HORSEPOWER RATING. WHEN THE AUTOMATIC-CONTROL DEVICE DOES NOT HAVE SUCH A RATING, A MAGNETIC STARTER SHALL BE USED WITH THE AUTOMATIC CONTROL DEVICE ACTIVATING THE COIL OF THE CONTACTOR.
- H. PROVIDE 3 POSITION MANUAL-OFF-AUTO SWITCH WHEN MANUAL AND AUTOMATIC CONTROL IS REQUIRED. CONNECT THE SELECTOR SWITCH SO THAT ONLY THE AUTOMATIC DEVICES ARE BY-PASSED WHEN THE SWITCH IS IN THE "MANUAL" POSITION. ALL SAFETY DEVICES SUCH AS PRESSURE AND TEMPERATURE SWITCHES, MOTOR OVERLOAD AND SAFETY SWITCHES SHALL BE ACTIVE IN "MANUAL" AND "AUTOMATIC" POSITIONS.
- I. MOTOR CONTROL CIRCUITS SHALL OPERATE AT 120V GROUNDED, OBTAINED FROM THE LOAD SIDE OF THE MOTOR-DISCONNECT MEANS. IF THE MOTOR CIRCUIT IS MORE THAN 120V TO GROUND, FURNISH A CONTROL TRANSFORMER WITH FUSED PRIMARY AND SECONDARY CIRCUITS. STARTERS FOR MOTORS WITH SPACE HEATERS SHALL HAVE CONTROL TRANSFORMERS SIZED FOR THE ADDITIONAL LOAD.
- J. FURNISH COMBINATION MOTOR STARTERS OF THE MOLDED CASE, MOTOR CIRCUIT PROTECTOR, CIRCUIT BREAKER TYPE, THREE PHASE, OF THE VOLTAGE AND SIZE AS SHOWN ON THE DRAWINGS BUT NOT SMALLER THAN THE SIZE REQUIRED BY THE CONTROLLED MOTOR, 120 VOLT CONTROL CIRCUIT, 3 THERMAL INTERCHANGEABLE OVERLOAD RELAYS, "HAND-OFF-AUTO" OR "ON-OFF" SWITCH AS REQUIRED BY THE APPLICATION, RED AND GREEN PILOT LIGHTS AND FOUR NORMALLY CLOSED AND NORMALLY OPEN INTERLOCK CONTACTS.
- K. THE STARTER DISCONNECT SHALL BE OPERABLE BY AN EXTERNAL "ON-OFF" LABELED HANDLE, INTERLOCKED TO PREVENT OPENING THE ENCLOSURE DOOR WHILE THE DISCONNECT IS IN THE "ON" POSITION EXCEPT WHEN CONSCIOUSLY OPERATING A PERMISSIVE RELEASE DEVICE.
- L. FURNISH STARTERS MANUFACTURED BY SQUARE D, CLASS 8536, ALLEN BRADLEY BULLETIN NO. 509, OR EQUAL.

7.0 PANEL BOARDS

A. PROVIDE DEAD FRONT CIRCUIT BREAKER TYPE PANEL BOARDS WITH COPPER BUS AND AS SCHEDULED ON DRAWINGS. EACH PANEL BOARD SHALL BE PROVIDED WITH A SEPARATE GROUND BUS IN ADDITION TO THE NEUTRAL BUS. CIRCUIT BREAKERS SHALL BE BOLT-ON AND HAVE A MINIMUM INTERRUPTING RATING OF 10,000 AMPERES AT 120 VOLTS, AND 14,000 AMPERES AT 277 VOLTS. A TYPEWRITTEN DIRECTORY SHALL CLEARLY IDENTIFY THE LOAD SERVED BY EACH CIRCUIT AND SHALL BE MOUNTED INSIDE THE DOOR IN A METAL FRAME WITH PLASTIC COVER. CIRCUIT NUMBERS SHALL BE PERMANENTLY INDICATED ADJACENT TO EACH CIRCUIT BREAKER.

8.0 GROUNDING

- A. INSTALL GROUNDING AS SHOWN ON DRAWINGS. WHERE NOT INDICATED, INSTALL IN COMPLIANCE WITH THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE. DO NOT USE CONDUCTORS SMALLER THAN SIZE AWG #12.
- B. INACCESSIBLE CONNECTIONS SHALL BE MADE WITH THE EXOTHERMIC WELDING PROCESS USING EQUIPMENT MANUFACTURED BY BURUNDY OR ERICO PRODUCTS OR EQUAL.
- C. ACCESSIBLE CONNECTIONS SHALL BE MADE WITH BURUNDY, MULTIPLE BOLT CONNECTORS SPECIFICALLY APPROVED FOR THE APPLICATION.
- D. TO ASSURE ELECTRICAL CONTINUITY, INSTALL JUMPERS ACROSS METAL PARTS SEPARATED BY NON-CONDUCTING MATERIALS OR ATTACHED TOGETHER BY HIGH RESISTANCE JOINTS.
- E. DO NOT EMBED GROUNDING CABLES DIRECTLY IN CONCRETE. USE SLEEVES WHEN PASSING CABLES THROUGH CONCRETE. BARE COPPER CABLES BURIED IN EARTH SHALL BE TINNED.
- F. FURNISH GROUND RODS OF COPPER CLAD STEEL, 3/4 INCH IN DIAMETER, 10 FEET LONG, DRIVEN FULL LENGTH INTO THE EARTH. MAXIMUM RESISTANCE TO GROUND IS LIMITED TO 25 OHMS. ADDITIONAL GROUND RODS SHALL BE DRIVEN IF REQUIRED TO MAINTAIN THIS LEVEL.
- G. PARTS TO BE GROUNDED: SWITCH GEAR AND PANEL BOARD FRAMES, FIXTURES AND DEVICES, CABLE SHEATHS, NEUTRAL OF TRANSFORMERS, BOXES AND RACEWAYS, MOTOR FRAMES, STREET LIGHTS, NON-CURRENT CARRYING PARTS OF APPLIANCES AND DEVICES, AND ALL OTHER PARTS AND EQUIPMENT AS REQUIRED BY NEC. NEVER US A NEUTRAL WIRE AS GROUNDING MEANS.
- H. BOND EQUIPMENT WITH CONDUCTORS INSTALLED IN SAME CIRCUIT RACEWAY AND SIZED AS FOLLOWS:
  1)EQUIPMENT RATED 50 AMPERES OR UNDER WITH ONE AWG #8.
  2)EQUIPMENT RATED 50 TO 125 AMPERES WITH ONE AWG #6.
  3)EQUIPMENT RATED OVER 125 AMPERES WITH ONE AWG #6 AND ONE# 1/0 IN 3/4 INCH CONDUIT TO BUILDING GROUND LOOP OR GROUND ROD.
- I. PROVIDE POWER AND LIGHTING CIRCUIT AND 120 VOLT GROUNDING RECEPTACLE WITH A GREEN GROUNDING CONDUCTOR OF THE SAME SIZE AND TYPE AS THE PHASE CONDUCTOR AND RUNNING IN THE SAME CONDUIT.
- J. MAKE BONDING TO EQUIPMENT WITH APPROVED SOLDERLESS CONNECTOR. CONTACT SURFACE SHALL BE UNPAINTED AND THOROUGHLY CLEANED BEFORE CONNECTION IS MADE TO INSURE A GOOD METAL CONTACT.

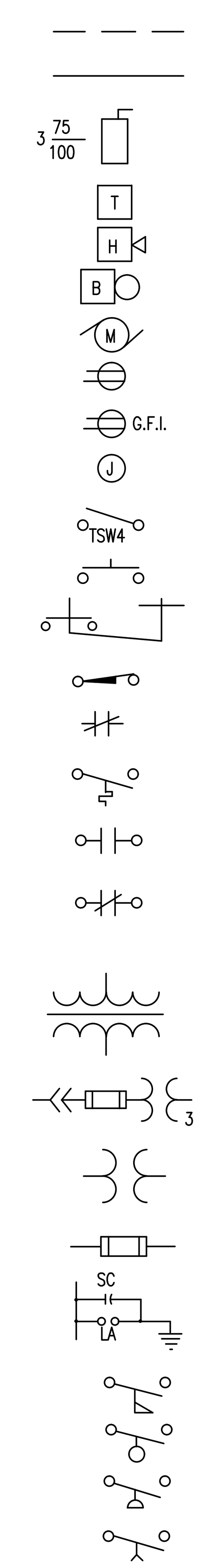
9.0 TRANSFORMERS

- A. FURNISH DRY TYPE, THREE OR SINGLE PHASE TRANSFORMERS OF THE SIZE AND VOLTAGE INDICATED ON THE DRAWINGS, WITH FOUR (TWO ABOVE AND TWO BELOW) 2-1/2 PROOF ENCLOSURE WITH FRONT ACCESSIBLE WIRING COMPARTMENT AND CONFORMING TO THE APPLICABLE REQUIREMENTS OF ANSI, IEEE, AND NEMA STANDARDS.
- B. CORE AND COIL ASSEMBLY TO BE VACUUM IMPREGNATED WITH CLASS H INSULATION. TEMPERATURE RISE NOT TO EXCEED 115 DEGREE C.
- C. TRANSFORMERS SOUND LEVEL NOT TO EXCEED FOLLOWING VALUES: 0 TO 9 KVA, 36 DB; 10 TO 45 KVA , 42 DAB; 50 TO 100 KVA, 45 DB.
- D. BOLT FLOOR MOUNTED TRANSFORMERS TO FLOOR. WHEN WALL MOUNTED, PROVIDE STEEL BRACKET ANGLES AND BOLT TRANSFORMER TO BRACKET. USE NEOPRENE ISOLATION PADS TO ISOLATE VIBRATIONS.
- E. ADJUST PRIMARY TAPS TO PROVIDE A SECONDARY VOLTAGE WITHIN + 5 OF NOMINAL VOLTAGE.

10.0 DUCT BANKS

- A. DUCT BANKS OF THE SIZE INDICATED ON DRAWINGS, SHALL CONSIST OF A NUMBER OF INDIVIDUAL PVC DUCTS AS INDICATED, ENCASED IN A REINFORCED CONCRETE ENVELOPE.
- B. USE PVC SCHEDULE 40 CONDUITS WITH MOLDED INTERLOCKING SPACERS. CONCRETE TO BE CLASS C, 2500 POUNDS PSI. PROVIDE # 12 AWG PULL WIRE IN ALL EMPTY CONDUITS.
- C. SLOPE DUCTS A MINIMUN OF 3 INCHES PER 100 FEET. SLOPE TO BE AWAY FROM BUILDINGS, FROM ONE MANHOLE TO THE NEXT OR BOTH WAYS FROM A HIGH POINT BETWEEN MANHOLES. KEEP THE HIGHEST POINT NOT LESS THAN 24 INCHES BELOW THE FINISHED GRADE.

SYMBOL-LEGEND:



UNDERGROUND POWER CONDUIT
ELECTRICAL CIRCUIT RUN EXPOSED
FUSED SAFETY SWITCH – NUMBER INDICATES POLES, TRIP AND FRAME – SIZE "O" FOR TRIP INDICATES A NON-FUSED SWITCH
TRANSFORMER
HORN
BELL
MOTOR
DUPLEX CONVENIENCE OUTLET
GROUND FAULT INTERRUPTER RECEPTACLE
JUNCTION BOX
TOGGLE SWITCH ON-OFF TYPE
PUSH BUTTON
PUSH BUTTON, ON-OFF TYPE, MAINTAINED POSITION.
LIMIT SWITCH
OVERLOAD
TEMPERATURE ACTUATED SWITCH
RELAY CONTACT NORMALLY OPEN, CLOSES ON ENERGIZATION, OPENS ON
RELAY CONTACT NORMALLY CLOSED, OPENS ON ENERGIZATION, CLOSES ON DE-ENERGIZATION
PWR. XFMR. 3PH. — DELTA CONNECTION / WYE GROUNDED, NEUTRAL CONNECTION
POTENTIAL XFMR. MEDIUM DRAWOUT PRIMARY FUSED NUMERAL INDICATES QUANTITY.
CONTROL POWER XFMR.
CURRENT LIMITING FUSE
SURGE CAPACITOR & LIGHTNING ARRESTER
FLOW SWITCH
FLOAT SWITCH
PRESSURE SWITCH
TIME DELAY RELAY CONTACT

NOTES:

1- ALL CIRCUITS TO CARRY A FULL GROUND WIRE PER N.E.C. ARTICLE 250.

2- ELECTRICAL SERVICE TO WITHSTAND UTILITY AVAILABLE FAULT CURRENT AND BUILT PER FPL STANDARD. CONTACT (PROVIDE FPL REPRESENTATIVE NAME AND PHONE NUMBER) PHONE (000)000-0000 F.P.L. REPRESENTATIVE IN THIS AREA.

3- SEE MECHANICAL AND STRUCTURAL DRAWINGS FOR INSTALLATION DETAILS.

4- SHORT CIRCUIT RATING (SCR) OF THE ELECTRICAL PANEL SHALL BE ###KA (MINIMUM 14 KA). FPL CORRESPONDING FAULT CURRENT LETTER TO BE INCLUDED IN DRAWINGS. PANEL TO BE FULLY RATED.

5- METER CAN AND MAIN DISCONNECT TO BE MOUNTED ON THE BACK OR SIDE OF CABINET IN A SEPARATE STRUCTURE. THEIR TOP SHALL NOT BE HIGHER THAN THE TOP OF CABINET.

6- MOTOR CIRCUIT BREAKER TO BE CAPABLE OF BEING PADLOCKED IN THE OPEN POSITION AND NOT OBSTRUCT CLOSING OR OPENING OF DEAD FRONT.

7- TELEMETRY ANTENNA FOUNDATION IS W.A.S.D. STANDARD AND COMPLIES WITH FBC.

8- "M" PANEL IS FACTORY FURNISHED AS AN INTEGRAL PART OF THE CONTROL PANEL.

9- MOTOR CIRCUIT PROTECTOR INDICATED IS AN ADJUSTABLE INSTANTANEOUS-TRIP MAGNETIC ONLY CIRCUIT BREAKERS FOR SINGLE MOTOR CIRCUIT PROTECTION AND ARE INTENDED FOR USE IN COMBINATION WITH MOTOR STARTERS WITH OVERLOAD RELAYS FOR THE PROTECTION OF MOTOR CIRCUITS FROM SHORT CIRCUITS AND OVERLOADS.

10- FOR 480V APPLICATIONS, CONNECT PANEL "M" MISCELLANEOUS LOADS TO A 7.5 KVA TRANSFORMER WITH OVERCURRENT PROTECTION AS SHOWN IN ONE LINE DIAGRAM (SHEET E-3) THE TRANSFORMER SHALL BE NEMA 3R, OR APPROVED FOR SPECIFIC LOCATION AND MOUNTED OUTSIDE THE CONTROL PANEL WITH ADEQUATE SUPPORTS. FOR 240V APPLICATIONS, PANEL "M" SHALL BE PROVIDED WITH A 2P, 40A, MAIN CIRCUIT BREAKER.

11- ALL CABLES SHALL BE LISTED BY A NATIONALLY RECOGNIZED TESTING LABORATORY. MOTOR WIRES SHOWN ARE MOTOR POWER AND GROUND ONLY. SUBMERSIBLE PUMP CABLES MULTICONDUCTOR TO BE FURNISHED BY THE MANUFACTURER AS AN INTEGRAL PART OF THE MOTOR. IF THE PUMP IS FURNISHED WITH SEPARATED POWER AND CONTROL CABLES; CONTRACTOR SHALL INCREASE THE SIZE OF THE CONDUITS AS REQUIRED.

12- PUMP CONTROL PANEL SHALL BE MANUFACTURED AND LABELED PER UL508 AND SUITABLE FOR SERVICE ENTRANCE USE.

13- PROVIDE MAIN, BACK-UP CONTROLLER AND PRESSURE TRANSDUCER NAME, MODEL & MANUFACTURER INFORMATION.

14- WET WELL IS A CLASS I DIVISION 1 AND VALVE BOX IS A CLASS 1 DIVISION 2 HAZARDOUS LOCATION AS PER NFPA 820. SEAL OFF SHALL COMPLY WITH NEC. 501. PRESSURE TRANSDUCER AND FLOAT SWITCHES TO BE ADEQUATE FOR CLASS 1 DIVISION 1 LOCATION. ELECTRICAL EQUIPMENT IN VALVE VAULT TO BE ADEQUATE FOR CLASS 1 DIVISION 2 LOCATION.

15- MAIN DISCONNECT SWITCH SIZED TO MATCH MAIN CIRCUIT BREAKER AND IN A PAD LOCKABLE SERVICE RATED, ### KA.I.C. MIN. NEMA 4X STAINLESS STEEL ENCLOSURE. TOP SHALL NOT BE HIGHER THAN THE TOP OF THE CABINET.

16- PANEL SHALL INCORPORATE A TAMPER/INTRUSION SWITCH (DC) THAT ACTIVATES AN ALARM TO THE RTU WHENEVER THE PANEL IS OPENED.

17- THE TEMPERATURE RATING ASSOCIATED WITH THE AMPACITY OF A CONDUCTOR SHALL COMPLY WITH NEC 110.

18- MAXIMUM GROUND RESISTANCE SHALL NOT EXCEED 25 OHMS PER ELECTRODE AS PER NEC ARTICLE 250.

19- ALL ELECTRICAL EQUIPMENT AND APPURTENANCES SHALL COMPLY WITH NEC 110.

20- MINIMUM CONDUIT SIZE TO BE 3/4" AND WIRE TO BE #12 CU.

21- LIGHTNING ARRESTOR AND SURGE CAPACITOR SHALL BE INSTALLED IN PANEL AND CONNECTED TO A MULTI-WIRE LUG IN MAIN CIRCUIT BREAKER BY CONTROL PANEL MANUFACTURER.

22- GROUNDING AND NEUTRAL CONDUCTORS SHALL BE BONDED AT ENTRANCE POINT ONLY.

23- PROVIDE PANEL MANUFACTURER'S RECOMMENDED SPARE PARTS FOR TWO YEARS.

24- A. THE CONTRACTOR SHALL FURNISH SHORT-CIRCUIT AND PROTECTIVE DEVICE COORDINATION STUDIES AS PREPARED BY THE ELECTRICAL EQUIPMENT MANUFACTURER OR AN APPROVED ENGINEERING FIRM.
B. THE CONTRACTOR SHALL FURNISH AN ARC FLASH HAZARD ANALYSIS STUDY PER THE REQUIREMENTS SET FORTH IN NFPA 70E – STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE, AND NEC 110. THE ARC FLASH ANALYSIS SHALL BE PERFORMED ACCORDING TO THE IEEE 1584 EQUATIONS THAT ARE PRESENTED IN THE LATEST CURRENT EDITION OF THE NFPA-70E.
C. THE CONTRACTOR OF THE ARC FLASH HAZARD ANALYSIS SHALL PROVIDE WARNING LABEL INDICATING SEVERITY OF POTENTIAL EXPOSURE AND LEVEL OF PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIRED. LABEL TO BE AS PER DETAIL IN SHEET E-3.

25- RTU ANTENNA FOUNDATION, POLE SUPPORT AND CONDUIT TO RTU PANEL, PROVIDED AND INSTALLED BY CONTRACTOR.

26- AS PER NEC ARTICLE 409.110 REQUIREMENTS, THE CONTROL PANEL SHALL BE MARKED WITH A SHORT CIRCUIT RATING THAT IS DETERMINED BY BEING A LISTED AND LABELED ASSEMBLY OR BY ANOTHER APPROVED METHOD.

27- INSTALL A MOTOR CONNECTION BOX AT A DISTANCE TO THE WET WELL NOT TO EXCEED 6 FEET. SEE DETAIL ON E-4.

28- INSTALL A CONVENIENCE CONTROL CONNECTION BOX AT A DISTANCE TO THE WET WELL NOT TO EXCEED 6 FEET. SEE DETAIL ON E-4.

29- PROVIDE RECEPTACLE AT A DISTANCE TO THE VALVE VAULT NOT TO EXCEED 6 FEET TO FEED PORTABLE SUMP PUMP. FLOAT SWITCH TO BE INSTALLED INSIDE THE VALVE VAULT TO SEND SIGNAL TO RTU AND TO CONTROL PANEL FOR LOCAL SIGNAL AS IT IS SHOWN ON CONTROL WIRING DIAGRAM AND RTU TERMINAL BLOCK ON SHEET E-3.

THESE ARE NOT CONSTRUCTION DRAWINGS. THE INFORMATION HEREIN CONTAINED SHALL ONLY BE USED AS GENERAL GUIDELINE OF THE INTENDED OPERATION AND FUNCTIONS AND SHALL NOT BE CONSTRUED AS ALL INCLUSIVE. ENGINEERS OF RECORD AND CONSULTANTS USING THESE GUIDELINES SHALL VERIFY AND MODIFY ANY REQUIREMENT NOT NECESSARILY SHOWN AS MAY BE REQUIRED BY ANY AND ALL APPLICABLE CODES AND STANDARDS.

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WATER & SEWER DEPARTMENT
3071 SW 38TH AVENUE
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305-665-7471
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ENGINEERING & DESIGN DIVISION
3575 S LE JEUNE RD
MIAMI, FL 33146
786-268-5250

PCTS 00000/CONTRACT X-000 or RPQ/ERX00000
SUBMERSIBLE PUMPING STATION WITH GENERATOR
PUMPING STATION No. 0000 (UPDATE 2015)
PROJECT OFFICIAL ADDRESS

ELECTRICAL GENERAL NOTES

DRAWING HISTORY

	RELEASED FOR	DATE	BY
X	REVIEW 90%	06/19/15	LMS
	REVIEW 00%		
	PERMIT		
	BID		
	AS-BUILT		

REVISIONS

No.	DESCRIPTION	DATE	BY
⚠	XXXXXX XXXXXX	06/19/15	LS

APPROVALS

PROJECT MGR: X.X.X.	CHECKED: X.X.X.
DESIGNED: X.X.X.	DRAWN: X.X.X.
CHIEF ENGINEER: J.B.F.	
DESIGN MNGR.: R.J.A.	
UNIT HEAD: L.S.	

Xxxx Xxxxx, P.E.
Xxxxx Engineer
State of Florida-License No.00000
Date:________

FILE NAME: 00000E01.DWG	
DATE: 06/19/2015	SCALE:

SHEET **E-1**

DWG. No. **S-00000-D**