4/21/2016 5:30:06 PM

ELECTRICAL SPECIFICATIONS

A. GENERAL:

1. SCOPE OF SERVICES - WORK SHALL INCLUDE THE FURNISHING AND INSTALLING OF A COMPLETE AND FUNCTIONING ELECTRICAL SYSTEMS FOR COMPONENTS INDICATED ON THE DRAWINGS AND THESE SPECIFICATIONS. THIS SHALL INCLUDE ACCESSORIES NECESSARY, WHETHER SPECIFICALLY STATED OR NOT, TO MAKE THE REQUIRED ELECTRICAL SYSTEMS COMPLETE AND OPERATIONAL. THIS WILL INCLUDE EVERY ARTICLE, DEVICE OR ACCESSORY NECESSARY TO FACILITATE EACH SYSTEM FUNCTIONING AS INDICATED BY THE DESIGN AND THE EQUIPMENT SPECIFIED. THE CONTRACTOR SHALL BECOME FAMILIAR WITH THE SITE AND ALL EXISTING CONDITIONS PRIOR TO BIDDING.

2. MATERIAL AND WORKMANSHIP - ALL EQUIPMENT AND MATERIALS PROVIDED SHALL BE NEW EXCEPT AS OTHERWISE STATED ON THE DRAWINGS. ALL EQUIPMENT PROVIDED SHALL BE UL LISTED WHEN SUCH STANDARDS EXIST FOR THE TYPE OF EQUIPMENT FURNISHED AND ACCEPTABLE FOR INSTALLATION OF THE LOCAL BUILDING AUTHORITY. ALL WORKMANSHIP SHALL BE BY LICENSED AND EXPERIENCED ELECTRICIANS OR JOURNEYMEN. ALL TOOLS, MACHINERY AND EQUIPMENT REQUIRED OF THE PERFORMANCE OF THE ELECTRICAL WORK SHALL BE FURNISHED BY THIS CONTRACTOR.

3. COORDINATION - THE CONTRACTOR SHALL COORDINATE ALL WORK WITH OTHER CONTRACTORS AND SUBCONTRACTORS SO THAT VARIOUS COMPONENTS OF THE ELECTRICAL SYSTEMS WILL BE INSTALLED AT THE PROPER TIME, WILL FIT THE AVAILABLE SPACE, AND WILL ALLOW PROPER SERVICE ACCESS TO ALL EQUIPMENT. THE CONTRACTOR SHALL REFER TO ARCHITECTURAL, STRUCTURAL AND MECHANICAL DRAWINGS AND TO RELEVANT EQUIPMENT DRAWINGS TO DETERMINE THE EXTENT OF CLEAR SPACES.

4. ORDINANCES AND CODES - CONTRACTOR'S PERFORMANCE, WORKMANSHIP AND MATERIALS SHALL COMPLY WITH APPLICABLE NATIONAL FIRE PROTECTION ASSOCIATION CODES, STATE AND LOCAL BUILDING CODES, AND/OR ALL OTHER APPLICABLE CODES AND ORDINANCES. ALL PERMITS, LICENSES AND FEES THAT ARE REQUIRED BY THE GOVERNING AUTHORITIES FOR THE PERFORMANCE OF THE ELECTRICAL WORK SHALL BE OBTAINED AND PAID FOR BY THE CONTRACTOR. FILLING OUT FORMS FOR APPLICATIONS BY THE ENGINEER WILL BE BILLED HOURLY TO THE CONTRACTOR.

B. COMMON WORK AND BASIC MATERIALS/EQUIPMENT:

1. GUARANTEE - GUARANTEE AGAINST DEFECTIVE WORKMANSHIP AND MATERIAL FOR A PERIOD OF ONE YEAR FROM THE DATE OF FINAL PAYMENT. GUARANTEE SHALL INCLUDE MATERIAL/EQUIPMENT TO BE REPLACED AND ALL LABOR REQUIRED.

2. TESTING, CHECK-OUT AND CLEANING - REPLACE ALL BURNED-OUT LED COMPONENTS. THE CONTRACTOR SHALL CLEAN ALL MATERIAL AND EQUIPMENT INSTALLED UNDER THE ELECTRICAL CONTRACT. DIRT, DUST, PLASTER, STAINS AND FOREIGN MATTER SHALL BE REMOVED FROM ALL SURFACES. ALL EQUIPMENT SHALL HAVE FINISH TOUCHED UP PRIOR TO INSPECTION. DAMAGED ELECTRICAL EQUIPMENT DURING THE CONSTRUCTION PROCESS SHALL BE REPLACED WITH NEW EQUIPMENT. ALL COSTS ASSOCIATED WITH THE DAMAGED EQUIPMENT SHALL BE ASSUMED BY THE INSTALLING CONTRACTOR.

3. CUTTING AND PATCHING - THIS CONTRACTOR SHALL DO ALL CUTTING OF WALLS, FLOORS, CEILINGS, ETC. AS REQUIRED TO INSTALL WORK UNDER THIS SECTION. CONTRACTOR SHALL PATCH WALLS, FLOORS, ETC. TO MATCH THE ORIGINAL MATERIAL AND CONSTRUCTION. CONTRACTOR SHALL REPAIR ALL FIRE/SMOKE RATED PENETRATIONS TO RETAIN RATING.

4. CONDUIT INSTALLATION - ALL WIRING SHALL BE ROUTED IN CONDUIT. CONDUIT SHALL BE INSTALLED CONCEALED WHEREVER POSSIBLE. EXPOSED CONDUIT SHALL BE PAINTED TO MATCH SURROUNDINGS. ALL CONDUIT BOXES SHALL BE ACCESSIBLE TO COMPLY WITH THE NEC. THE MINIMUM CONDUIT SIZE SHALL BE 0.75" UNLESS OTHERWISE NOTED ON THE DRAWINGS. CONDUIT TYPES SHALL BE THE FOLLOWING:

   RMC - SHALL BE USED ABOVE GRADE AT CONNECTIONS TO EQUIPMENT, UNDERGROUND CONDUIT ELBOWS, AND ELBOWS EXTENDING UP THROUGH THE SLAB. PROVIDE WITH GASKETED FITTINGS IN PUMP ROOM AND CHLORINATION ROOM.

   PVC - SHALL BE USED IN UNDERGROUND CONDUIT APPLICATIONS.

   LMC - SHALL BE USED FOR CONNECTIONS TO EQUIPMENT SUBJECT TO MOVEMENT OR VIBRATION. CONDUIT SHALL BE NO GREATER THAN 36" IN LENGTH AND FOR LIGHITNG WHIPS. CONDUIT SHALL BE PROVIDED WITH SEPARATE GROUND CONDUCTOR. CONDUIT MAY NOT BE UTILIZED AS GROUND PATH.

   EMT AND FMC ARE NOT ALLOWED.

5. UNDERGROUND CONDUIT - SCHEDULE 40 PVC WITH RMC FOR ELBOWS AND ABOVE GRADE. WHERE INSTALLED BELOW SLAB, CONDUIT SHALL BE SURROUNDED ON ALL SIDES WITH 2" OF AGGREGATE.

6. WIRE - ALL WIRE SHALL HAVE COPPER CONDUCTORS, WITH U.L. LISTING. ALL FEEDER AND BRANCH CIRCUIT WIRE #8 AWG AND LARGER SHALL BE TYPE THWN OR XHHW, BOTH WITH STRANDED CONDUCTORS. ALL WIRE #10 AND SMALLER AWG SHALL BE TYPE THWN (WET OR DAMP LOCATIONS, OR IN CONDUIT BELOW GRADE OR SLAB) OR THHN (DRY LOCATIONS ONLY AND ABOVE GROUND). BOTH WITH SOLID CONDUCTORS. ALL BRANCH CIRCUIT WIRING SHALL BE NOT SMALLER THAN #12 AWG WIRE.

7. WIRING INSTALLATION - ALL WIRING SHALL BE INSTALLED IN APPROVED RACEWAY AND ENCLOSURES. ALL SPLICES OR TAPS SHALL OCCUR IN APPROVED BOXES AND ENCLOSURES, AND SHALL BE MADE UP WITH APPROVED SOLDERLESS CONNECTORS. FOR #10 CONDUCTORS AND SMALLER THE CONDUCTORS SHALL HAVE INSULATION OF THE PROPER COLOR TO MATCH NEC COLOR CODE SYSTEM. FOR CONDUCTORS OF #8 AND LARGER THE CONTRACTOR MAY USE COLORED PRESSURE SENSITIVE PLASTIC TAPE AT EACH END TO PROPERLY IDENTIFY THE CONDUCTOR VOLTAGE PER THE NEC. ALL BRANCH CIRCUITS SHALL HAVE AN EQUIPMENT GROUNDING CONDUCTOR INSTALLED IN THE RACEWAY, SIZED IN ACCORDANCE WITH NEC 250-122. COMPLY WITH VOLTAGE DROP SECTION IN THIS SPECIFICATION.

8. HANGERS AND SUPPORTS - SUPPORTS FOR RMC SHALL BE AS REQUIRED BY NFPA 70. THE MINIMUM HANGER ROD SIZE SHALL BE 1/4" DIAMETER. TRAPEZE STYLE SUPPORTS FABRICATED TO SUPPORT MULTIPLE RACEWAYS SHALL BE SIZED SUCH THAT CAPACITY CAN BE INCREASED BY 25% IN FUTURE WITHOUT EXCEEDING LOAD LIMITS. COORDINATE MOUNTING ANCHORAGE TYPES WITH STRUCTURAL SUPPORT SYSTEM PRESENT IN BUILDING. THE FOLLOWING ANCHORAGE TYPES WILL BE ALLOWED BASED ON APPROVAL FROM THE STRUCTURAL ENGINEER:
   NEW CONCRETE: BOLT TO CONCRETE INSERTS.
   EXISTING CONCRETE: EXPANSION ANCHOR FASTENERS.
   MASONRY: APPROVED TOGGLE TYPE BOLTS ON HOLLOW MASONRY UNITS AND EXPANSION ANCHOR FASTENERS ON SOLID MASONRY UNITS.
   STEEL: WELDED THREADED STUDS WITH LOCK WASHERS AND NUTS OR BEAM CLAMPS.
   LIGHT STEEL: SHEET METAL SCREWS.

9. LOW VOLTAGE CABLING SUPPORT - ALL LOW VOLTAGE CABLING SHALL BE ROUTED IN CONDUIT.

10. DEVICES - DEVICES SHALL BE SPECIFICATION GRADE. COMMERCIAL OR RESIDENTIAL GRADE DEVICES ARE NOT ACCEPTABLE. DEVICES SHALL BE GRAY. DEVICE PLATES SHALL BE STEEL. ACCEPTABLE MANUFACTURERS SHALL BE ARROW HART, BRYANT, HUBBELL, LEVITON, AND PASS & SEYMOUR.
    GROUND FAULT CIRCUIT INTERRUPTER RECEPTACLES SHALL BE CORROSION RESISTANCE NEMA 5-20R TYPE WITH FAULT SENSOR DESIGNED TO DETECT 4-6 mA LEAKAGE IN 25 MILLISECONDS OR LESS.
    SWITCHES SHALL BE 20A, SINGLE POLE, DOUBLE THROW. 3-WAY AND 4-WAY SWITCHES SHALL BE DOUBLE POLE.

11. BOXES - ALL BOXES SHALL BE METALLIC TYPE UNLESS OTHERWISE NOTED ON THE DRAWINGS

    INTERIOR BOXES SHALL BE GALVANIZED SHEET STEEL. BOXES FOR SWITCHES AND RECEPTACLES SHALL BE 4" SQUARE, 2-1/8" DEEP. BOXES SHALL BE INSTALLED SUCH THAT DEVICE COVERS ARE TIGHT AND PLUMB WITH FINISHED SURFACE.

    EXTERIOR BOXES SHALL BE CORROSION RESISTANT, CAST-METAL, WEATHERPROOF OUTLET WIRING BOXES. RECEPTACLES SHALL HACK A METAL, EXTRA DUTY, WEATHER PROOF-IN-CASE COVER.

    JUNCTION BOXES AND PULL BOXES SHALL BE INSTALLED WHERE REQUIRED FOR CONDUCTOR PULLING AND BEND RADIUS REQUIREMENTS PER THE NEC.

12. VOLTAGE DROP - ALL BRANCH CIRCUITS SUPPLYING EQUIPMENT, LIGHTING, OR DEVICES SHALL BE SIZED NOT TO EXCEED 3% VOLTAGE DROP, AND NOT EXCEED 5% VOLTAGE DROP FROM SOURCE (E.G. TRANSFORMER, SERVICE, ETC) TO LOAD. DERATE CONDUCTORS PER NEC WHEN ROUTED IN RACEWAY CONTAINING MORE THAN THREE CURRENT CARRYING CONDUCTORS. PROVIDE BUCK-BOOST TRANSFORMERS MEETING THE REQUIREMENTS OF THE TRANSFORMER SECTION WHEN VOLTAGE DROP EXCEEDS 3% FROM OVERCURRENT DEVICE TO END DEVICE.

13. EQUIPMENT AND DEVICE GROUNDING - ALL CONDUCTORS, CONDUITS, MOTOR FRAMES, ETC. WHICH REQUIRE GROUNDING SHALL BE PERMANENTLY AND EFFECTIVELY GROUNDED BY THIS CONTRACTOR IN A THOROUGH AND EFFICIENT MANNER CONFORMING IN ALL PARTICULARS TO THE NATIONAL ELECTRICAL CODE. ALL CIRCUITS MUST BE PROVIDED WITH A SEPARATE GROUND CONDUCTOR. CONTRACTOR SHALL NOT UTILIZE THE RACEWAY AS A GROUND PATH UNDER ANY CIRCUMSTANCE.

14. BUILDING GROUNDING - GROUND THE BUILDING ELECTRICAL SERVICE PER THE ADOPTED VERSION OF THE NEC AND DETAILS INDICATED ON THE DRAWINGS. GROUND RODS UTILIZED FOR BUILDING GROUNDING SHALL BE 3/4" DIAMETER AND 10'-0" IN LENGTH. A MINIMUM OF (2) GROUND RODS SHALL BE INSTALLED WITH A COUPLER TO CREATE A 20'-0" LONG GROUND ROD. CONTRACTOR SHALL BOND THE BUILDING GROUND TO ALL AVAILABLE GROUNDING LOCATIONS PER ARTICLE 250 OF THE NEC.

15. EQUIPMENT PADS AND CONCRETE BASES - INTERIOR PADS AND BASES - UNLESS SPECIFIED ELSEWHERE IN THE CONTRACT DRAWINGS, PROVIDE MINIMUM 4" THICK CONCRETE PAD 28 DAY 3000 PSI. PAD SHALL EXTEND 4" BEYOND EQUIPMENT FOOTPRINT ON ALL SIDES.

16. MOTORS - CONTRACTOR SHALL FURNISH AND INSTALL ALL COMPONENTS FOR A COMPLETE AND FUNCTIONING SYSTEM INCLUDING BUT NOT LIMITED TO DISCONNECTS, STARTERS AND CONTROL WIRING. SIZE FEEDER TO ACCOUNT FOR VOLTAGE DROP PER THIS SPECIFICATION.

17. LABELING - ALL DEVICES SHALL BE LABELED THAT ARE MODIFIED IN ANY WAY BY THIS PROJECT.

a. ALL PANELBOARDS (NEW OR THAT HAVE CIRCUITS MODIFIED) SHALL HAVE INSTALLED A NEW TYPED CIRCUIT DIRECTORY UPDATED WITH ALL AVAILABLE INFORMATION.
b. ALL NEW OR AFFECTED DISCONNECTS, STARTERS, TRANSFORMERS, AND PANELS SHALL HAVE A PHENOLIC, WHITE TEXT ON BLACK, MINIMUM 1/2 INCH HIGH TEXT LABELING WITH THE DEVICES NAME, VOLTAGE AND WIRING SYSTEM (EXAMPLE: "PANEL A, 120/208V, 3 PHASE, 4 WIRE") AND OTHER INFORMATION PER THE OWNER.
c. ALL NEW, RELOCATED, OR REWIRED RECEPTACLES, SWITCHES AND OTHER DEVICES INCLUDING THOSE ABOVE SHALL BE LABELED WITH THE SOURCE OF POWER. THIS LABEL SHALL BE ON THE DEVICE COVER PLATE AND SHALL HAVE BLACK ON WHITE HELVETICA MEDIUM FONT LETTERING 1/4 INCH HIGH, DESIGNATING PANELBOARD AND CIRCUIT NUMBER SEPARATED BY COLON. THE SAME TYPE LABEL SHALL ALSO BE INSTALLED ON THE DEVICE BEHIND THE COVERPLATE.

C. DISTRIBUTION EQUIPMENT:

1. MANUFACTURERS - ALL COMPONENTS SHALL BE BY ONE OF THE FOLLOWING UNLESS OTHERWISE NOTED: EATON CUTLER HAMMER, GENERAL ELECTRIC, SIEMENS, OR SQUARE D.

2. GROUND BUS - ALL PANELS, DISTRIBUTION PANELS, AND SWITCHBOARDS SHALL BE PROVIDED WITH A COPPER GROUND BUS.

3. SERIES RATING - SERIES RATING OF CIRCUIT BREAKERS IN NOT ALLOWED UNLESS SPECIFICALLY NOTED ON THE CONTRACT DRAWINGS.

4. PANELBOARDS - FURNISH AND INSTALL PANELBOARDS AS SCHEDULED AND NOTED ON THE DRAWINGS. THE PANELBOARDS SHALL BE COMPLETE WITH THERMAL MAGNETIC PLASTIC CASE CIRCUIT BREAKERS OF THE BOLT-ON TYPE ASSEMBLED IN A FINISHED CABINET. ALL 2 AND 3 POLE BREAKERS MUST BE COMMON TRIP. EACH PANEL SHALL CONTAIN A TYPEWRITTEN OR COMPUTER PRINTED CIRCUIT DIRECTORY. ALL PANELBOARDS SHALL BE FURNISHED WITH A HINGED FRONT COVER. PANELBOARDS SHALL BE INSTALLED WITH TOP AT 6'-6" A.F.F. UNLESS OTHERWISE NOTED SUCH THAT BREAKER ACCESSIBILITY LOCATIONS COMPLY WITH NFPA 70.

   PANELBOARDS SHALL BE DEAD FRONT TYPE AND BUS BARS SHALL BE TIN PLATED ALUMINUM.

   THE MINIMUM SHORT CIRCUIT RATING OF ANY DEVICE INSTALLED IN A PANEL SHALL BE 10,000 AIC OPERATING AT 120/208V.

5. LOW VOLTAGE TRANSFORMERS (600V AND LESS) - TRANSFORMERS SHALL BE RATED FOR 150 DEG C INSULATION CLASS. TRANSFORMER SHALL BE ALUMINUM OR COPPER WOUND TYPE. TRANSFORMERS LOCATED INDOORS IN DRY LOCATIONS SHALL BE PROVIDED WITH VENTILATED, NEMA TYPE 2 RATED ENCLOSURES. TRANSFORMERS SHALL BE GROUNDED AS SEPARATELY DERIVED SYSTEMS PER NFPA 70.

6. SAFETY SWITCHES - FURNISH AND INSTALL FUSED OR NON-FUSED (AS REQUIRED) HEAVY DUTY SAFETY SWITCHES WHERE NOT FURNISHED WITH THE EQUIPMENT, AND AT ALL OTHER POINTS REQUIRED BY CODE. CONSTRUCTION SHALL BE OF A NEMA DESIGN SUITABLE FOR THE ENVIRONMENT INSTALLED. ALL FUSES SHALL BE BUSSMAN, LITTELFUSE OR FERRAZ-SHAWMUT, SIZE AND TYPE AS REQUIRED OR INDICATED.

7. SURGE PROTECTIVE DEVICES - PROVIDE SURGE PROTECTIVE DEVICES AS INDICATED ON THE DRAWINGS. SURGE PROTECTIVE DEVICES LOCATED INTEGRAL TO THE PANEL MAY BY SUPPLIED BY EATON CUTLER HAMMER, SQUARE D, SIEMENS, OR GE. SURGE PROTECTIVE DEVICES MOUNTED OUTSIDE OF THE PANEL MAY BE SUPPLIED BY LIEBERT, CURRENT TECHNOLOGY, OR ADVANCED PROTECTION TECHNOLOGIES.

   SURGE PROTECTIVE DEVICES SHALL BE RATED AS FOLLOWS:

   SERVICE ENTRANCE LOCATIONS: 250 kA PER PHASE AND 125 kA PER MODE.

   BRANCH PANELS: 120 kA PER PHASE AND 60 kA PER MODE.

   SPD'S MOUNTED EXTERNAL TO PANELS SHALL BE LOCATED SUCH THAT THE CONDUCTOR/CONDIT RUN BETWEEN THE EQUIPMENT IS AS SHORT AND STRAIGHT AS POSSIBLE. PROVIDE OVERCURRENT PROTECTION OF THE SPD AS REQUIRED BY THE EQUIPMENT MANUFACTURER.

8. VARIABLE FREQUENCY DRIVES - 6 PULSE WITH THE FOLLOWING UNLESS OTHERWISE SPECIFIED ON THE DRAWINGS:

8.1. THE VFD SHALL BE ENCLOSED IN A UL LISTED TYPE 1 ENCLOSURE. THE TOLERATED VOLTAGE WINDOW SHALL ALLOW THE VFD TO OPERATE FROM A LINE OF +30% NOMINAL, AND -35% NOMINAL VOLTAGE AS A MINIMUM.
8.1.1. ENVIRONMENTAL OPERATING CONDITIONS: 0 TO 40C CONTINUOUS DUTY. VFD'S THAT CAN OPERATE AT 40 C INTERMITTENTLY (DURING A 24 HOUR PERIOD) ARE NOT ACCEPTABLE AND MUST BE OVERSIZED. ALTITUDE 0 TO 3300 FEET ABOVE SEA LEVEL, LESS THAN 95% HUMIDITY, NON-CONDENSING.
8.2. ALL VFD'S SHALL HAVE THE FOLLOWING STANDARD FEATURES:
8.2.1. ALL VFD'S SHALL HAVE THE SAME CUSTOMER INTERFACE, INCLUDING DIGITAL DISPLAY, AND KEYPAD. THE KEYPAD SHALL BE REMOVABLE, CAPABLE OF REMOTE MOUNTING AND ALLOW FOR UPLOADING AND DOWNLOADING OF PARAMETER SETTINGS AS AN AID FOR START-UP OF MULTIPLE VFD'S.
8.2.2. THE KEYPAD SHALL INCLUDE HAND-OFF-AUTO SELECTIONS AND MANUAL SPEED CONTROL. THE DRIVE SHALL INCORPORATE "BUMPLESS TRANSFER" OF SPEED REFERENCE WHEN SWITCHING BETWEEN "HAND" AND "AUTO" MODES. THERE SHALL BE FAULT RESET AND "HELP" BUTTONS ON THE KEYPAD. THE HELP BUTTON SHALL INCLUDE "ON-LINE" ASSISTANCE FOR PROGRAMMING AND TROUBLESHOOTING.
8.2.3. THERE SHALL BE A BUILT-IN TIME CLOCK IN THE VFD KEYPAD. THE CLOCK SHALL BE USED TO DATE AND TIME STAMP FAULTS AND RECORD OPERATING PARAMETERS AT THE TIME OF FAULT. THE CLOCK SHALL ALSO BE PROGRAMMABLE TO CONTROL START/STOP FUNCTIONS, CONSTANT SPEEDS, PID PARAMETER SETS AND OUTPUT RELAYS.
8.2.4. UTILIZE PRE-PROGRAMMED APPLICATION MACROS SPECIFICALLY DESIGNED TO FACILITATE START-UP. THE APPLICATION MACROS SHALL PROVIDE ONE COMMAND TO REPROGRAM ALL PARAMETERS AND CUSTOMER INTERFACES FOR A PARTICULAR APPLICATION TO REDUCE PROGRAMMING TIME.
8.2.5. CAPABLE OF STARTING INTO A COASTING LOAD (FORWARD OR REVERSE) UP TO FULL SPEED AND ACCELERATE OR DECELERATE TO SETPOINT WITHOUT SAFETY TRIPPING OR COMPONENT DAMAGE (FLYING START).
8.2.6. THE VFD SHALL HAVE THE ABILITY TO AUTOMATICALLY RESTART AFTER AN OVER-CURRENT, OVER-VOLTAGE, UNDER-VOLTAGE, OR LOSS OF INPUT SIGNAL PROTECTIVE TRIP. THE NUMBER OF RESTART ATTEMPTS, TRIAL TIME, AND TIME BETWEEN ATTEMPTS SHALL BE PROGRAMMABLE.
8.2.7. THE VFD SHALL HAVE AN INTEGRAL 5% IMPEDANCE REACTOR. THE 5% IMPEDANCE MAY BE FROM DUAL (POSITIVE AND NEGATIVE DC BUS) REACTORS, OR 5% AC LINE REACTORS. VFD'S WITH ONLY ONE DC REACTOR SHALL ADD AC LINE REACTORS.
8.2.8. THE VFD SHALL INCLUDE A COORDINATED AC TRANSIENT PROTECTION SYSTEM CONSISTING OF 4-120 JOULE RATED MOV'S (PHASE TO PHASE AND PHASE TO GROUND), A CAPACITOR CLAMP, AND 5% IMPEDANCE REACTORS.
8.2.9. THE VFD SHALL BE CAPABLE OF SENSING A LOSS OF LOAD (BROKEN BELT / BROKEN COUPLING) AND SIGNAL THE LOSS OF LOAD CONDITION. THE DRIVE SHALL BE PROGRAMMABLE TO SIGNAL THIS CONDITION VIA A KEYPAD WARNING, RELAY OUTPUT AND/OR OVER THE SERIAL COMMUNICATIONS BUS. RELAY OUTPUTS SHALL INCLUDE PROGRAMMABLE TIME DELAYS THAT WILL ALLOW FOR DRIVE ACCELERATION FROM ZERO SPEED WITHOUT SIGNALING A FALSE UNDERLOAD CONDITION.
8.2.10. IF THE INPUT REFERENCE (4-20MA OR 2-10V) IS LOST, THE VFD SHALL GIVE THE USER THE OPTION OF EITHER (1) STOPPING AND DISPLAYING A FAULT, (2) RUNNING AT A PROGRAMMABLE PRESET SPEED, (3) HOLD THE VFD SPEED BASED ON THE LAST GOOD REFERENCE RECEIVED, OR (4) CAUSE A WARNING TO BE ISSUED, AS SELECTED BY THE USER. THE DRIVE SHALL BE PROGRAMMABLE TO SIGNAL THIS CONDITION VIA A KEYPAD WARNING, RELAY OUTPUT AND/OR OVER THE SERIAL COMMUNICATION BUS.
8.3. ALL VFD'S TO HAVE THE FOLLOWING ADJUSTMENTS:
8.3.1. TWO (2) PID SETPOINT CONTROLLERS IN THE DRIVE. TWO (2) PROGRAMMABLE ANALOG INPUTS SHALL ACCEPT CURRENT OR VOLTAGE SIGNALS.
8.3.2. TWO (2) PROGRAMMABLE ANALOG OUTPUTS (0-20MA OR 4-20 MA) PROGRAMMABLE TO OUTPUT PROPORTIONAL TO FREQUENCY, MOTOR SPEED, OUTPUT VOLTAGE, OUTPUT CURRENT, MOTOR TORQUE, MOTOR POWER (KW), DC BUS VOLTAGE, ACTIVE REFERENCE, AND OTHER DATA.
8.3.3. SIX (6) PROGRAMMABLE DIGITAL INPUTS. THERE SHALL BE A RUN PERMISSIVE CIRCUIT FOR DAMPER OR VALVE CONTROL. AT ANY RUN COMMAND, THE VFD SHALL PROVIDE A DRY CONTACT CLOSURE THAT WILL SIGNAL THE DAMPER TO OPEN. WHEN THE DAMPER IS FULLY OPEN, A NORMALLY OPEN DRY CONTACT SHALL CLOSE. THE CLOSED END-SWITCH IS WIRED TO AN VFD DIGITAL INPUT AND ALLOWS VFD MOTOR OPERATION. TWO SEPARATE SAFETY INTERLOCK INPUTS SHALL BE PROVIDED. WHEN EITHER SAFETY IS OPENED, THE MOTOR SHALL BE COMMANDED TO COAST TO STOP, AND THE DAMPER SHALL BE COMMANDED TO CLOSE. THE KEYPAD SHALL DISPLAY "START ENABLE 1 (OR 2) MISSING". THE SAFETY STATUS SHALL ALSO BE TRANSMITTED OVER THE SERIAL COMMUNICATIONS BUS. ALL DIGITAL INPUTS SHALL BE PROGRAMMABLE TO INITIATE UPON AN APPLICATION OR REMOVAL OF 24VDC.
8.3.4. THREE (3) PROGRAMMABLE DIGITAL FORM-C RELAY OUTPUTS. THE RELAYS SHALL INCLUDE PROGRAMMABLE ON AND OFF DELAY TIMES AND ADJUSTABLE HYSTERESIS. DEFAULT SETTINGS SHALL BE FOR RUN, NOT FAULTED, AND RUN PERMISSIVE. THE RELAYS SHALL BE RATED FOR MAXIMUM SWITCHING CURRENT 8 AMPS AT 24 VDC AND 0.4 A AT 250 VAC; MAXIMUM VOLTAGE 300 VDC AND 250 VAC; CONTINUOUS CURRENT RATING 2 AMPS RMS. OUTPUTS SHALL BE TRUE FORM C TYPE CONTACTS.
8.3.5. THE VFD SHALL INCLUDE A MOTOR FLUX OPTIMIZATION CIRCUIT THAT WILL AUTOMATICALLY REDUCE APPLIED MOTOR VOLTAGE TO THE MOTOR.
8.3.6. THE VFD SHALL INCLUDE A CARRIER FREQUENCY CONTROL CIRCUIT THAT REDUCES THE CARRIER FREQUENCY BASED ON ACTUAL VFD TEMPERATURE THAT ALLOWS THE HIGHEST CARRIER FREQUENCY WITHOUT DERATING THE VFD OR OPERATING AT HIGH CARRIER FREQUENCY ONLY AT LOW SPEEDS.
8.4. SERIAL COMMUNICATIONS
8.4.1. EACH VFD SHALL HAVE AN RS-485 PORT AS STANDARD WITH MODBUS, JOHNSON CONTROLS N2 BUS, AND SIEMENS BUILDING TECHNOLOGIES FLN PROTOCOLS. OPTIONAL PROTOCOLS FOR LONWORKS, BACNET, PROFIBUS, ETHERNET, AND DEVICENET SHALL BE AVAILABLE. ALL PROTOCOLS SHALL BE "CERTIFIED" BY THE GOVERNING AUTHORITY.
8.4.2. SERIAL COMMUNICATION CAPABILITIES SHALL INCLUDE RUN-STOP CONTROL, SPEED SET ADJUSTMENT, PROPORTIONAL/INTEGRAL/DERIVATIVE PID CONTROL ADJUSTMENTS, CURRENT LIMIT, ACCEL/DECEL TIME ADJUSTMENTS, AND LOCK AND UNLOCK THE KEYPAD. THE DRIVE SHALL HAVE THE CAPABILITY OF ALLOWING THE CONTROL SYSTEM TO MONITOR FEEDBACK SUCH AS PROCESS VARIABLE FEEDBACK, OUTPUT SPEED / FREQUENCY, CURRENT, % TORQUE, POWER, KILOWATT HOUR, OPERATING HOURS, AND DRIVE TEMPERATURE. THE CONTROL SYSTEM SHALL ALSO BE CAPABLE OF MONITORING THE VFD RELAY OUTPUT STATUS, DIGITAL INPUT STATUS, AND ALL ANALOG INPUT AND ANALOG OUTPUT VALUES. ALL DIAGNOSTIC WARNING AND FAULT INFORMATION SHALL BE TRANSMITTED OVER THE SERIAL COMMUNICATIONS BUS. REMOTE VFD FAULT RESET SHALL BE POSSIBLE. THE FOLLOWING ADDITIONAL STATUS INDICATIONS AND SETTINGS SHALL BE TRANSMITTED OVER THE SERIAL COMMUNICATIONS BUS - KEYPAD "HAND" OR "AUTO" SELECTED, BYPASS SELECTED, THE ABILITY TO CHANGE THE PID SETPOINT, AND THE ABILITY TO FORCE THE UNIT TO BYPASS. THE CONTROL SYSTEM SYSTEM SHALL ALSO BE ABLE TO MONITOR IF THE MOTOR IS RUNNING IN THE VFD MODE OR BYPASS MODE OVER SERIAL COMMUNICATIONS. A MINIMUM OF 15 FIELD PARAMETERS SHALL BE CAPABLE OF BEING MONITORED.
8.5. EMI / RFI FILTERS. ALL VFD'S SHALL INCLUDE EMI/RFI FILTERS.
8.6. BYPASS FEATURES - FEATURES TO BE FURNISHED AND MOUNTED BY THE DRIVE MANUFACTURER.
8.6.1. A COMPLETE FACTORY WIRED AND TESTED BYPASS SYSTEM CONSISTING OF AN OUTPUT CONTACTOR AND BYPASS CONTACTOR. OVERLOAD PROTECTION AND SHALL BE PROVIDED IN BOTH MODES.
8.6.2. DOOR INTERLOCKED, PADLOCKABLE CIRCUIT BREAKER THAT WILL DISCONNECT ALL INPUT POWER FROM THE DRIVE AND ALL INTERNALLY MOUNTED OPTIONS.
8.6.3. FAST ACTING FUSES EXCLUSIVE TO THE VFD - FAST ACTING FUSES ALLOW THE VFD TO DISCONNECT FROM THE LINE PRIOR TO CLEARING UPSTREAM BRANCH CIRCUIT PROTECTION, MAINTAINING BYPASS CAPABILITY. BYPASS DESIGNS, WHICH HAVE NO SUCH FUSES, OR THAT INCORPORATE FUSES COMMON TO BOTH THE VFD AND THE BYPASS WILL NOT BE ACCEPTED.
8.6.4. THE DRIVE / BYPASS SHALL PROVIDE SINGLE-PHASE MOTOR PROTECTION IN BOTH MODES.
8.6.5. THE FOLLOWING INDICATING LIGHTS (LED TYPE) SHALL BE PROVIDED. A TEST MODE OR PUSH TO TEST FEATURE SHALL BE PROVIDED: POWER-ON (READY), RUN ENABLE (SAFETIES) OPEN, DRIVE MODE SELECT DAMPER OPENING, BYPASS MODE SELECTED, DRIVE RUNNING, BYPASS RUNNING, DRIVE FAULT, BYPASS FAULT, BYPASS H-O-A MODE, AUTOMATIC TRANSFER TO BYPASS SELECTED, SAFETY OPEN, DAMPER OPENING, DAMPER END-SWITCH MADE
8.6.6. THE FOLLOWING RELAY (FORM C) OUTPUTS FROM THE BYPASS SHALL BE PROVIDED: SYSTEM STARTED, . SYSTEM RUNNING, BYPASS OVERRIDE ENABLED, DRIVE FAULT, BYPASS FAULT (MOTOR OVERLOAD OR UNDERLOAD), BYPASS H-O-A POSITION.
8.6.7. THE DIGITAL INPUTS FOR THE SYSTEM SHALL ACCEPT 24V OR 115VAC (SELECTABLE). THE BYPASS SHALL INCORPORATE INTERNALLY SOURCED POWER SUPPLY.
8.6.8. DEDICATED DIGITAL INPUT THAT WILL TRANSFER MOTOR FROM VFD MODE TO BYPASS MODE UPON DRY CONTACT CLOSURE FOR FIREMAN'S OVERRIDE. TWO MODES OF OPERATION ARE REQUIRED:
8.6.8.1. ONE MODE FORCES THE MOTOR TO BYPASS OPERATION AND OVERRIDES BOTH THE VFD AND BYPASS H-O-A SWITCHES AND FORCES THE MOTOR TO OPERATE ACROSS THE LINE. THE SYSTEM WILL ONLY RESPOND TO THE DIGITAL INPUTS AND MOTOR PROTECTIONS.
8.6.8.2. THE SECOND FIREMAN'S OVERRIDE MODE REMAINS AS ABOVE, BUT WILL ALSO DEFEAT THE OVERLOAD AND SINGLE-PHASE PROTECTION FOR BYPASS AND IGNORE ALL KEYPAD AND DIGITAL INPUTS TO THE SYSTEM (RUN UNTIL DESTRUCTION).
8.6.9. THE VFD SHALL INCLUDE A "RUN PERMISSIVE CIRCUIT" THAT WILL PROVIDE A NORMALLY OPEN CONTACT WHENEVER A RUN COMMAND IS PROVIDED (LOCAL OR REMOTE START COMMAND IN VFD OR BYPASS MODE). THE VFD SYSTEM SHALL NOT OPERATE THE MOTOR UNTIL IT RECEIVES A DRY CONTACT CLOSURE FROM A DAMPER OR VALVE END-SWITCH. WHEN THE VFD SYSTEM SAFETY INTERLOCK (FIRE DETECTOR, FREEZESTAT, HIGH STATIC PRESSURE SWITCH, ETC) OPENS, THE MOTOR SHALL COAST TO A STOP AND THE RUN PERMISSIVE CONTACT SHALL OPEN, CLOSING THE DAMPER OR VALVE.
8.6.10. CLASS 20 OR 30 (SELECTABLE) ELECTRONIC MOTOR OVERLOAD PROTECTION SHALL BE INCLUDED.
8.6.11. THERE SHALL BE AN INTERNAL SWITCH TO SELECT MANUAL OR AUTOMATIC BYPASS.
8.6.12. THERE SHALL BE AN ADJUSTABLE CURRENT SENSING CIRCUIT FOR THE BYPASS TO PROVIDE LOSS OF LOAD INDICATION (BROKEN BELT) WHEN IN THE BYPASS MODE.
8.7. INSTALLATION
8.7.1. INSTALLATION SHALL BE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR. THE CONTRACTOR SHALL INSTALL THE DRIVE IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE VFD MANUFACTURER AS OUTLINED IN THE INSTALLATION MANUAL.
8.7.2. POWER WIRING SHALL BE COMPLETED BY THE ELECTRICAL CONTRACTOR. 3 COPPER CONDUCTORS AND A GROUND WIRE ARE REQUIRED. SEPARATE THE INPUT POWER WIRING FROM THE OUTPUT POWER WIRING IN INDIVIDUAL METALLIC CONDUIT. DO NOT COMBINE PROVIDE A SEPARATE METALLIC CONDUIT FOR CONTROL WIRING. THE CONTRACTOR SHALL COMPLETE ALL WIRING IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE VFD MANUFACTURER AS OUTLINED IN THE INSTALLATION MANUAL.
8.8. START-UP
8.8.1. CERTIFIED FACTORY START-UP SHALL BE PROVIDED FOR EACH DRIVE BY A FACTORY AUTHORIZED SERVICE CENTER. A CERTIFIED START-UP FORM SHALL BE FILLED OUT FOR EACH DRIVE WITH A COPY PROVIDED TO THE OWNER, AND A COPY KEPT ON FILE AT THE MANUFACTURER.
8.9. PRODUCT SUPPORT
8.9.1. FACTORY TRAINED APPLICATION ENGINEERING AND SERVICE PERSONNEL THAT ARE THOROUGHLY FAMILIAR WITH THE VFD PRODUCTS OFFERED SHALL BE LOCALLY AVAILABLE AT BOTH THE SPECIFYING AND INSTALLATION LOCATIONS. A 24/365 TECHNICAL SUPPORT LINE SHALL BE AVAILABLE ON A TOLL-FREE LINE.
8.10. WARRANTY
8.10.1. WARRANTY SHALL BE 24 MONTHS FROM THE DATE OF CERTIFIED START-UP, NOT TO EXCEED 30 MONTHS FROM THE DATE OF SHIPMENT. THE WARRANTY SHALL INCLUDE ALL PARTS, LABOR, TRAVEL TIME AND EXPENSES. THERE SHALL BE 365/24 SUPPORT AVAILABLE VIA A TOLL FREE PHONE NUMBER.

D. DATA AND INSTRUMENTATION:

9. FLOW TRANSMITTER - FIT-100
9.1. RECOMMENDED METER - FOXBORO 9300A FLOW TUBE, MOD # 9308 - 8" FLANGED #150
9.1.1. FLOW TRANSMITTER WILL MEASURE WATER FLOW FROM P-001, 002, 003, PUMPS. METER WILL HAVE 4-20 MA OUTPUT AS WILL AS SCALABLE PULSE OUTPUTS. TRANSMITTER WILL BE MOUNTED ON FLOW TUBE. TRANSMITTER CONTROL PANEL WITH PUSH BUTTON CONTROLS WILL FACE WALK WAY TO AID FIELD ADJUSTMENTS. TRANSMITTER WILL BE A FOXBORO MODEL IMT25 I/A SERIES INTELLIGENT MAGNETIC FLOW TRANSMITTER WITH HART COMMUNICATION PROTOCOL. THE METER WILL COME WITH NECESSARY SOFTWARE CONFIGURATION FOR COMMUNICATION TO SCADA- PLC, TOTALS AND SET POINTS WILL BE PROTECTED IN NONVOLATILE MEMORY IN THE EVENT OF POWER LOSS. RELAY (2) OUTPUTS WILL BE FIELD PROGRAMMABLE FOR FLOW ALARMS. TRANSMITTER BODY & FLOW METER TERMINALS WILL BE ENCLOSED IN A NEMA 4X RATED ENCLOSURE. POWER FOR THE FLOW METER WILL BE 24VDC SUPPLIED FROM PLC/SCADA POWER SUPPLIES.
10. LEVEL TRANSMITTER - LT-101
10.1. RECOMMENDED - NON CONTACT RADAR, ROSEMONT 5400 SERIES OR KPSI MODEL 750 SUBMERSIBLE LEVEL TRANSDUCER WITH VENTED CABLE ASSEMBLY, NON FOULING DIAPHRAGM, VENT FILTER AND 4-20MA OUTPUT.
10.1.1. THE LEVEL TRANSMITTER WILL MEASURE WATER LEVEL IN THE WET WELL BASIN. LT-101 WILL HAVE A 4-20MA OUTPUT AND BE FIELD ADJUSTABLE.
11. PRESSURE TRANSMITTER - PT-102
11.1. RECOMMENDED - FOXBORO - IGP10 WITH A ANDERSON GREENWOOD M25VIS4M TWO VALVE MANIFOLD
11.1.1. THE PRESSURE TRANSMITTER SHALL MEASURE GAUGE PRESSURE TO MAINTAIN CONSTANT PRESSURE READINGS AND OUTPUT TO 4-20MA TO PLC - PRESSURE CONTROLLER (PC-102). PT-102 WILL BE A HIGH PERFORMANCE D/P CELL TRANSMITTER - IT WILL HAVE A LOCAL DIGITAL READOUT. TRANSMITTER WILL COMMUNICATE HART WITH ANALOG OUTPUTS. METER WILL READ IN GAUGE PRESSURES AND BE PAIRED WITH A 2 VALUE BLOCK & BLEED TYPE MANIFOLD FOR MAINTENANCE & CALIBRATION OF THE METER. THE METER WILL OUT PUT PUMP STATION PRESSURE. THE METER WILL HAVE A REFERENCE ACCURACY OF 0.025% OF SPAN.
12. LEVEL SWITCH - LS 103A AND LS 103B
12.1. RECOMMENDED MANUF. SJE RHOMBUS MODEL # 20SGMSPDTPC PART # 1006096
12.1.1. CABLE IS 18 GAUGE (MIN) 20 FOOT LONG 3 CONDUCTOR (UL) SJOW, WATER RESISTANT (CPE) FLOAT 2.75" DIA. X 4.83 IN LONG HIGH IMPACT CORROSION RESISTANT POLYPROPYLENE FOR USE IN SEWAGE AND WATER UP TO 140°F (60°C) MUST BE MERURY FREE. ELECTRICAL RATING - 5AMP, 125/250VAC, 50/60HZ
13. PLC CONTROL PANEL
13.1. SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:
13.1.1. THE WWTP NO.2 GRAY WATER PUMP STATION PLC CONTROL PANEL.
13.1.2. WILL OPERATE ON 120 VAC/60 HZ/1 PHASE ELECTRICAL SERVICE.
13.1.3. NEMA 12 WALL MOUNT , PAINTED STEEL ENCLOSURE (APROX. 48"H X36"W X 16D") WITH BACK PANEL.
13.1.4. INCOMING TVSS WITH SERVICE BREAKER.
13.1.5. GE RX3I PLC RACK WITH PROCESSOR, POWER SUPPLY & I/O AS REQUIRED.
13.1.6. GE RX3I ETHERNET COMMUNICATIONS MODULE
13.1.7. PHOENIX CONTACT 21.5" INDUSTRIAL TOUCH PANEL PC WITH WONDERWARE SYSTEM PLATFORM RUNTIME LICENSE.
13.1.8. MOXA INDUSTRIAL COPPER / FIBER ETHERNET SWITCH (TYPE SC, MULTI-MODE).
13.1.9. NETWORK DC POWER SUPPLY.
13.1.10. 1500 VA UPS WITH SIMPLEX PLUG IN RECEPTACLE.
13.1.11. 12 PORT FIBER OPTIC PATCH PANEL. (TYPE SC, MULTI-MODE)
13.1.12. (2) FIBER OPTIC JUMPER ASSEMBLIES.
13.1.13. WIRING TERMINALS, WIRE WAYS, RECEPTACLES, FUSES, BREAKERS, RELAYS, ETC. AS REQUIRED…
14. UV BUILDING SCADA CONTROL PANEL (EXISTING) MODIFICATIONS
14.1. SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:
14.1.1. MOXA INDUSTRIAL COPPER/ FIBER ETHERNET SWITCH (TYPE SC, MULTI MODE) .
14.1.2. DC POWER SUPPLY.
14.1.3. 12 PORT FIBER OPTIC PATCH PANEL. (TYPE SC, MULTI-MODE).
14.1.4. FIBER OPTIC JUMPER CABLE ASSEMBLIES AS REQUIRED.
14.1.5. WIRING TERMINALS, FUSES, ECT. AS REQUIRED.
14.2. INSTALLATION AND WIRING OF PANEL MOUNTED COMPONENTS FURNISHED BY R.E. PEDROTTI CO.
15. DOCUMENTATION
15.1. ALL DOCUMENTATION AND AS-INSTALLED O&M MANUALS WILL BE PROVIDED TO MKEC AND THE CITY OF WICHITA FOR APPROVAL AND RECORDS.
15.2. ALL RED LINED, DURING CONSTRUCTION, DRAWINGS AND PROGRAMMING DOCUMENTS WILL BE RETURNED TO MKEC AND CITY OF WICHITA BY THE CONTRACTOR RESPONSIBLE FOR THE INSTALLATION.
16. PLC / SCADA PROGRAMMING
16.1. PUMP STATION PLC/HMI PROGRAMMING DEVELOPMENT AND SYSTEM WIDE SCADA APPLICATION UPDATES TO INCORPORATE NEW GRAY WATER PUMP STATION IN TO WPC SCADA SYSTEM.
17. ONSITE OPERATOR TRAINING AND TESTING:
17.1. ONSITE CONTROL PANEL AND INSTRUMENT START UP, TESTING AND OPERATOR TRAINING WILL BE PROVIDED BY THE AUTOMATION CONTRACTOR.
18. ETHERNET CABLING:
18.1. SOLID CONDUCTOR - BONDED PAIRS
18.2. SHALL HAVE ADJUSTABLE PULL TENSION FOR INSTALLATION
18.3. OIL RESISTANT
18.4. AV SUN RESISTANCE
18.5. 600V WHERE EXPOSED TO ELECTRICAL VOLTAGES -> 300V
18.6. INDUSTRIAL GRADE JACKET - PVC
18.7. CABLE SHALL BE SUITABLE FOR DATA SPEEDS
19. CABLE TERMINATIONS
19.1. SHALL BE SUITABLE FOR THE CABLE SELECTED
19.2. CABLE TERMINAL ENDS - WILL MEET MANUFACTURER'S REQUIREMENTS. MUST BE ROBUST IN NATURE CONNECTION AND SERVICEABLE.

D. LIGHTING:

1. GENERAL - THE LOCATIONS, NUMBERS, SIZES AND TYPES OF LIGHTING FIXTURES SHALL BE AS SHOWN ON THE CONTRACT DOCUMENTS. ALL LIGHTING FIXTURES FURNISHED UNDER THIS CONTRACT TO HAVE UL LABELS ATTACHED TO EACH FIXTURE OR AN INTEGRAL PART OF THE DEVICES FOR 120V AND 277V SOLID-STATE EQUIPMENT. FOR DEVICES WITHOUT INTEGRAL LINE VOLTAGE SURGE PROTECTION, FIELD MOUNTING SURGE PROTECTION SHALL COMPLY WITH IEEE C62.41, WITH UL 1449. METAL PARTS SHALL BE FREE FROM BURRS, SHARP CORNERS AND EDGES. DOORS, FRAMES AND OTHER INTERNAL ACCESSES SHALL BE SMOOTH OPERATING, FREE FROM LIGHT LEAKAGE UNDER OPERATING CONDITIONS, AND ARRANGED TO PERMIT RELAMPING WITHOUT USE OF TOOLS. ARRANGE DOORS, FRAMES, LENSES, DIFFUSERS AND OTHER PIECES TO PREVENT ACCIDENTAL FALLING DURING RELAMPING AND WHEN SECURED IN OPERATING POSITION. LENSES, DIFFUSERS, COVERS AND GLOBES SHALL BE 100 PERCENT VIRGIN ACRYLIC PLASTIC OR ANNEALED CRYSTAL GLASS, UNLESS OTHERWISE INDICATED. PLASTIC SHALL BE HIGH RESISTANCE TO YELLOWING AND OTHER CHANGES DUE TO AGING, EXPOSURE TO HEAT AND ULTRAVIOLET RADIATION.
   CLEAN ALL LIGHT FIXTURES AFTER INSTALLATION AND PRIOR TO OWNER ACCEPTANCE. TEST EACH FIXTURE AND REPLACE ALL MALFUNCTIONING LEDS AND DRIVERS.

2. LED FIXTURES AND DRIVERS - MANUFACTURERS SHALL BE AS SHOWN ON THE CONTRACT DRAWINGS. LED DRIVER AND HEAT SINK SHALL BE MATCHED TO PROVIDE 50,000 HOURS OF LAMP LIFE.

E. CONSTRUCTION:

1. SUBMITTALS - SUBMIT FOR REVIEW ELECTRONIC SETS OF MANUFACTURERS CUT SHEETS AND/OR SHOP DRAWINGS OF LIGHT FIXTURES WITH LAMPS AND LIGHT FIXTURE BASE, AND ALL ITEMS IN THIS SPECIFICATION OTHER THAN WIRE AND CONDUIT. ALSO SUBMIT ITEMS REQUIRING COORDINATION BETWEEN CONTRACTORS. BEFORE SENDING SUBMITTALS, THE CONTRACTOR SHALL VERIFY THAT ALL EQUIPMENT SUBMITTED IS MUTUALLY COMPATIBLE AND SUITABLE FOR THE INTENDED USE, AND SHALL FIT THE AVAILABLE SPACE AND ALLOW AMPLE ROOM FOR MAINTENANCE. THE ENGINEER'S REVIEW AND COMMENT ON SUCH SUBMITTALS SHALL NOT RELIEVE THE CONTRACTOR FROM RESPONSIBILITY FOR ERRORS IN DIMENSIONS, DETAILS, SIZE OF MEMBERS, OR QUANTITIES; OR OMISSIONS OF COMPONENTS OR FITTINGS; OR FOR COORDINATING ITEMS WITH ACTUAL PROJECT CONDITIONS.

F. SUBSTITUTIONS:

1. MATERIAL ALTERNATES SHALL BE SUBMITTED IN COMPLETE DETAIL TO THE ENGINEER NO LATER THAN 10 CALENDAR DAYS PRIOR TO BID DATE. DECISION ON ACCEPTANCE OF A SUBSTITUTION IS SOLELY UP TO THE ENGINEER.

Joel Richard Bradley Wheeler
LICENSED
24496
4-21-16
KANSAS
PROFESSIONAL ENGINEER

MKEC
Wichita. KS • 316-684-9600

CITY OF WICHITA, KANSAS
RE-USE WATER PUMP STATION
TO SERVE SPIRT AEROSYSTEMS

ELECTRICAL SPECIFICATIONS

PROJECT NO.	468-85112
DATE	04/18/16
SCALE	AS NOTED

DESIGNED	DRAWN	CHECKED
JRBW	JA	JRBW

NO.	REVISION	DATE
0	ISSUED FOR CONSTRUCTION	04/18/16

SHEET NO.
E4.3

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