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| | | switches installed out-of-doors, in corrosive areas, or in wet or damp areas shall be thoroughly cleaned of surface films after installation, primed and painted with paint selection and color as approved by the Engineer. | |
| 2. | | Fuses shall be provided to correspond to the recommendations and requirements of the actual load being served and shall be dual-element type. | |
| 16125 | DRY-TYPE TRANSFORMERS | | |
| A. | Dry type transformers shall be K-Factor rated for non-linear loads of the two winding type, self-cooled, with 60Hz ratings as indicated on the electrical plans. Unless specified otherwise, provide standard NEMA taps, standard impedance, low noise sound levels, and TPI rated. Transformers shall be Siemens or approved equal. Transformers shall be designed, manufactured, and tested in accordance with ANSI, NEMA and IEEE Standards and shall be UL Listed. The self-cooled kVA rating shall be suitable for 30°C average, 40°C maximum ambient temperature. Non-Linear rated transformers shall be suitable for non-sinusoidal loads and harmonic distortion as indicated in IEEE C57.110, and shall be designed with the K-Factor rating K13 for 100% Non-Linear load. Non-Linear rated transformers shall be UL Listed and shall bear the UL marking on the nameplate along with the specified K-Factor rating. Non-Linear rated transformers shall include the following design features: | | |
| | a) Core designed to withstand voltage distortion and high frequency harmonic currents. Magnetic flux density designed to reduce eddy currents and prevent saturation or overheating of the core. | | |
| | b) Primary and secondary coils designed to minimize stray losses, skin effect losses, and excessive heating from harmonic currents. Coils shall not exceed the specified winding temperature rise, the corresponding hot spot temperature rating, or the 220°C insulation rating while carrying the specified Non-Linear load. | | |
| | c) Neutral bus sized for 200% of rated current to withstand circulating currents and triplen harmonics. | | |
| | d) An Electrostatic Shield between the primary and secondary winding and grounded to a common point within the transformer enclosure. When properly grounded, the shield shall provide noise isolation and attenuate common mode and transverse mode noise transients under normal loading conditions. | | |
| | Unless noted otherwise, transformers rated 15 kVA and larger shall be a ventilated dry type with a UL Listed 220°C insulation system. Units shall be designed to operate with a rated maximum temperature rise of 150°C with 220°C insulated conductors. Non-ventilated transformers shall be rated for 115°C temperature rise with 180°C insulated conductors. Construction shall consist of copper windings and arranged to brace coil layers and provide maximum ventilation (Provide optional cost for aluminum windings). Cores shall be constructed of non-ageing electrical grade steel with high magnetic permeability and low loss characteristics. Core laminations shall be tightly assembled. The complete core and coil assembly shall be impregnated with non-hygroscopic thermosetting varnish to provide a high dielectric, moisture resistant, and flame retardant seal. Core and coil assemblies shall be constructed to provide short circuit with stand capability as defined by ANSI and NEMA standards. The complete assembly shall be installed on vibration dampening pads to reduce noise and securely bolted to the enclosure base. A flexible grounding conductor shall be installed between the core and coil assembly and the transformer enclosure Enclosures shall be ventilated, heavy gauge steel construction finished with light gray paint. Front and rear covers shall be removable to provide access to the terminal compartment. Terminals shall be fully sized to carry the transformer full load current and shall be arranged to accept required UL-Listed cable connectors. Units installed outdoors shall have a UL-Listed type 3R outdoor enclosure. | | |
| B. | General purpose three phase transformers shall be delta primary, wye secondary connected. Unless specified otherwise, (150°C rise) shall meet the following low noise sound levels, 3db below the following ANSI NEMA standards: 0 to 9 kVA 40 dB 10 to 50 kVA 45 dB 51 to 150 kVA 50 dB. Sound ratings shall conform to NEMA decibel levels. Transformers shall be provided with sound isolating acoustic mounting pads. At least two, 2-1/2 percent high voltage winding taps below normal voltage shall be provided. | | |
| C. | General purpose transformers shall be provided with appropriate enclosures for free-standing or wall supporting type mounting as applicable. Floor mounting transformers located indoors shall be provided with sound isolating type acoustic pads for sound and vibration transmission reduction. Ventilated enclosures shall have insect screens on all openings. Transformers installed in damp locations, corrosive areas, or out-of-doors shall be suitable for outdoor installation and shall be thoroughly cleaned of surface films after installation, and primed and painted with paint selection and color as approved by the Engineer. | | |
| D. | Transformers shall be grounded in accordance with NEC Article 250.30. | | |
| E. | Correct location of primary and secondary conduit stub-ups shall be the responsibility of the contractor. | | |
| F. | Lifting eyes and jacking pads shall be provided | | |
| G. | Residential Transformers TRN01A and TRN01B ratings are as follows: Siemens type RSP 500KVA, 480V delta primary-208V/120V wye secondary Provide with 6 -2.5% taps (2FCAN, 4 FCBN) | 16100-10 | |

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| | | Designed to operate with a rated maximum temperature rise of 115°C with 220°C insulated conductors | |
| | | NEMA 3R enclosure | |
| | | Integral primary circuit breaker with shunt trip. Primary circuit breaker shall be thermal magnetic type sized per NEC requirements and manufacturers recommendation. | |
| 16126 | FUSES | | |
| A. | Motors and General Purpose Fuses | | |
| | Unless otherwise noted, fuses provided for motor protection and other general purpose loads shall be dual-element type, "Bus Fusetron" or equal by Shawmut, with voltage and current ratings as required. Fuses for motor loads, hermetically sealed compressors, and other special purpose equipment shall have ampere ratings selected in accordance with the recommendations of the equipment manufacturer associated therewith. | | |
| | B. Control Fuse | | |
| | Control circuit fuses shall be "Bus FNM" for 120 volt circuits and "Bus KTC" for 480 volt circuits or equal by Shawmut. Unless otherwise noted, control circuit fuses shall be installed in terminal strip mounted switch action fuse blocks rated for 15 amps at 600 volts. | | |
| 16127 | CIRCUIT BREAKERS | | |
| A. | Industrial Type | | |
| | 1. Branch and feeder circuit breakers shall be thermal-magnetic, molded case, industrial type, unless otherwise noted, and shall be listed by the Underwriters Laboratories, Inc. for not less than 14,000 amps symmetrical interrupting at 480 volts. Voltage, trip and frame current ratings, and number of poles shall be as indicated or required. Circuit breakers shall have trip-free operating handles with trip current rating permanently molded therein. | | |
| | 2. Circuit breakers provided within the main service and distribution assembly shall be rated for 65 K amps interrupting capacity at 480 volts. | | |
| | B. Motor Starters | | |
| | Circuit breakers provided as an integral part of combination motor starters may be thermal-magnetic type as specified herein or may be magnetic only type manufactured specifically for motor protection duty and set for the associated current value corresponding to motor the actual motor nameplate data. | | |
| | C. General Duty | | |
| | Circuit breakers provided to serve 120 volt lighting, receptacles, and small loads shall be rated by Underwriters Laboratories, Inc. for not less than 10,000 amps symmetrical interruption, and otherwise shall be as specified herein. Multiple circuit breakers shall be factory assembled and sealed. Tandem type breakers and ballast load handles of single unit breakers are not acceptable for this work. | | |
| | D. Circuit breakers provided for refrigeration equipment shall be UL approved for the duty intended. | | |
| | E. Circuit breakers intended as lighting circuit switches shall be listed by the manufacturer "for switching duty". | | |
| 16128 | PANELBOARDS | | |
| | Panelboards shall be UL approved, dead-front construction, circuit breaker type, with enclosure type as indicated. Conductive components including main power bus, ties, ground bus, and terminal lugs shall be copper. Branch circuits shall be arranged as shown on the panel schedules. Electrical ratings and special features shall be as noted. "Load Center" style panelboards will not be acceptable. Circuit breakers shall be in accordance with Paragraph entitled "Circuit Breakers". Enclosure doors shall have latch and flush mounted turnbuckle type locks and shall have a typed circuit directory fastened to the inside surface. Panelboard installed out-of-doors, in corrosive areas, or in wet or damp areas shall be thoroughly cleaned of surface films after installation, primed and painted with paint selection and color as approved by the Engineer. All panelboards shall be lockable and locks shall be keyed alike. Each panelboard shall be equipped with transient voltage surge suppressor (TVSS). | | |
| 16129 | LIGHTING FIXTURES | | |
| A. | Fixtures | | |
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| | | Lighting fixtures shall be of types shown on the drawings with ratings as noted. Where fixtures other than as shown are proposed, submit data shall include photometric characteristics, physical description, and a complete listing of necessary lamps, ballasts and hardware. Lighting fixtures shall be of USA domestic manufacture. | |
| B. | Where lighting fixtures interfere with duct work or other structural features, adjustments shall be made to the layout pattern as approved by the Engineer. Lighting fixtures shall be installed plumb and shall be complete with all required adapters, accessories, hangers, connectors, etc. | | |
| C. | Lamps shall be new and shall be of types and wattage ratings as indicated. Unless otherwise noted, fixtures shall carry the maximum recommended lamp capacity. Unless otherwise noted, incandescent lamps shall be incandescent, 130 volt rated, and fluorescent lamps shall have standard cool-white, color characteristics. | | |
| 16131 | MOTORS | | |
| A. | General | | |
| | Motors provided as an integral part of unit equipment and coordinated with the driven item or items, shall conform to the specifications and requirements for the equipment under other sections of these specifications, including shafts, belts, mounting, guards, etc. Where motors are not specified as noted above, or otherwise addressed by the Contract, motors shall conform to the general specifications hereinafter. | | |
| B. | Motor Ratings | | |
| | Motors shall be of sufficient size, design and type for the duty to be performed. The motor horsepower, current, and temperature nameplate ratings within the limits of a 1.0 service factor shall not be exceeded when the driven equipment is operated at specified capacity under the most severe conditions expected to be encountered. Horsepower ratings indicated on the electrical drawings are for guidance only and are not intended to limit the equipment size. When electrically driven equipment materially differs from the contemplated design, it shall be the responsibility of the Contractor, after evaluation and approval by the Engineer and the Owner, to make the necessary adjustment to the wiring, controllers, disconnect devices, branch circuit protection, etc., in order to accommodate the equipment actually installed at the Contractor's expense. Coordination of all revisions among the electrical, mechanical, structural, etc., disciplines shall be the responsibility of the Contractor. | | |
| C. | Accessories | | |
| | Where noted on the drawings or elsewhere within these specifications, motors shall be equipped with internal, factory installed space heaters, motor winding overtemperature sensors, moisture sensors, etc. Field additions of these auxiliary items will not be considered satisfactory. | | |
| D. | Type and Design | | |
| | Unless otherwise noted, motors installed in wet or humid locations shall be totally enclosed, fan cooled (TEFC) type with 1.0 service factor and motors installed in dry locations shall be open drip-proof type with 1.15 service factor. Vertical mounted style motors installed out-of-doors larger than 10 hp shall be weatherprotected type WP-1. Windings shall be either epoxy encapsulated or vacuum-pressure impregnated. Winding leads shall have non-hygroscopic type insulation. Motors shall be cast iron construction with integral mounting feet or flange, NEMA design B, Class "F" or "H" insulated copper windings, rated at 40°C ambient unless otherwise noted and shall have horsepower, speed and electrical characteristics as indicated. Special features shall be provided as required. Bearings shall be ball type rated for the type shaft loading and thrust applied by the specific load connected, and shall be grease lubricated with fill and overflow ports unless otherwise noted. | | |
| 16132 | MOTOR STARTERS | | |
| A. | General | | |
| | Starters shall be sized in whole number increment NEMA designation with voltage rating poles, and enclosure as noted or otherwise required. Starters shall be approved by Underwriters Laboratories, Inc. Ambient temperatures compensated overcurrent protection shall be provided in each ungrounded phase of the circuit and shall be sized to suit the motor provided. Auxiliary equipment including contacts, selector switches, pushbuttons, lights, control power transformer, fuses, etc., shall be provided as noted or otherwise required. | | |
| B. | Design Standards | | |
| | Starters shall be designed and rated in accordance with NEMA Table 2-321-1. Ratings by IEC, VDE, DIN, etc., WILL NOT be considered for this work. Terminal temperature rise rating shall not exceed 50°C. Operating coils and overcurrent sensors shall be readily and independently replaceable in the field without requiring complete starter exchange. | | |
| C. | Control Power Transformer | | |
| | Control power transformers shall have current limiting type fuses in each primary winding lead in addition to the fuse in the ungrounded secondary winding lead. The following minimum capacity ratings shall be provided. Where control items are to be | | |
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| | | powered in addition to the starter coil such as lights, running time meters, relays, solenoids, etc., the minimum capacities shown hereinafter shall be increased by the total additional loads. | |
| | | STARTER SIZE CPT RATING (min) | |
| | | 1 100 VA | |
| | | 2 150 VA | |
| | | 3 150 VA | |
| | | 4 300 VA | |
| D. | Starter Types | | |
| | 1. Starters indicated as being combination type shall be circuit breaker type motor circuit protector combination type set to suit the motor provided. | | |
| | 2. Starters shall be magnetic type, full voltage, non-reversing, NEMA Size 1 minimum with wiping style contacts, unless otherwise noted. | | |
| | 3. Starters noted as manual type shall have toggle switching action with voltage, poles, horsepower and enclosure as noted or otherwise required. | | |
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| 16135 | SPECIAL CONTROL PANELS | | |
| A. | Cabinet | | |
| | Contractor supplied control panels shall be surface mounted, NEMA 12 steel (or as otherwise specified) in dry indoor areas and NEMA 4X stainless steel in wet or exterior areas. Control components shall be as indicated on the drawings. NEMA 12 cabinets and doors shall be interior finished in baked white enamel and exterior finished in ASA standard light gray over gray prime coat with all surfaces phosphatized prior to painting. Dimensions shall be as shown on drawings. Stainless steel cabinets shall be brushed finished. All drilling and cutting shall be smooth, and escutcheon plates or bezel rings shall be provided on all openings. | | |
| B. | Control Components and Wiring | | |
| | Control components and associated items shall be as shown on the drawings and in accordance with other applicable paragraphs of this specification. Component arrangements shall be as shown on the drawings. Panel manufacturer shall completely wire the panel using AWG No. 14 (minimum) conductors rated 90NHV, 75°C (minimum). Each end of all conductors shall be identified with permanent type markers corresponding to Shop Drawing wiring diagram submitted for the control panel. All field wiring shall be connected to terminal strip or lugs of starters, contactors, or other larger components. Each conductor within the panel shall be labeled at each end for identification. | | |
| C. | Submittals | | |
| | Shop drawings showing physical dimensions, component placement and complete coordinated composite control diagrams and elementary diagrams shall be submitted to the Engineer for approval and shall show the individual control components by manufacturer's catalog number and the wire numbers actually connected in the completed installation. Complete coordinated drawings are to include all devices internal and external to the control panel. | | |
| 16136 | CONTROL COMPONENTS | | |
| A. | Switches, Pushbuttons, Pilot Lights | | |
| | Selector switches, pushbuttons and indicator lights unless otherwise noted shall be round style, heavy-duty, oil-tight type equal to Square D, Class 9001, Type K, or Siemens Class 52 and shall have nameplate lettering as noted on the drawings. Miniature style units will not be acceptable unless otherwise noted on the drawings. Operator mechanism including locking ring and legend plate in corrosive atmospheres or wet areas shall be NEMA 4X rated. Switch contacts shall be arranged for the configuration and duty as indicated, and operating handles shall be easily operated by hand without the use of tools. Pushbuttons shall be momentary or maintained contact type as indicated. Switches and pushbuttons located remotely from the controller shall be provided with lockout features. Indicator light lenses shall be glass type with color as noted. Lamp replacement shall require removal of the front mounted lens cap only. Where control unit exhibits corrosion or other physical failure during the contract time frame, the Contractor shall replace the entire unit at the expense of the Contractor. | | |
| B. | Relays | | |
| | 1. Control relays shall be equal to Square D, Type X, or equal, 300 ohm, fixed mounting type, molded case frame industrial type, with number of poles, contact arrangements, and operating voltage as indicated. Contacts shall be convertible type and shall be readily replaceable without requiring complete relay exchange. Open style, "Toe Cube" style, and plug-in type | | |
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| | | relays will not be considered for this work unless specifically noted on the drawings. Relays shall be NEMA rated and Underwriters Laboratories, Inc. approved. Ratings by IEC, VDE, DIN, etc., will not be considered for this work. Relays noted to have time delay actions shall be adjustable type with time delay values as noted. Relays with voltage ratings or designated as special purpose relays shall be provided where indicated. | |
| 2. | Pilot relays shall be provided to establish an intrinsically safe control circuit and shall be solid state sensing with NEC Class I, Division 1, external sensing circuit; 8 amp output control contacts; and 120V, AC input. Relay unit shall be Warrick 1A1CO or approved equal. | | |
| F. | Control Power Transformers | | |
| | Control power transformer shall be machine tool type, two-winding, dry-type, with copper windings. Voltage ratings and VA capacity shall be selected to suit the load and power system. | | |
| G. | Photocell Units | | |
| | Photocell units shall be a twist-locking weatherproof type with matching receptacles. The unit shall be rated for a 1500W, 120V load. The unit shall incorporate a cadmium sulfide photocell and an internal time delay to prevent nuisance and transient false operations. Unit shall be TORX 2033, or equal. | | |
| H. | Alarm Horn | | |
| | Alarm horn shall be an outdoor type with cast aluminum housing rated for weatherproof duty. The unit shall have solid state control circuitry and operate on 120 Vac, shall have a built-in volume control, and shall be capable of 110 db at 10 feet. Sound projector shall be oriented as noted on the drawings. Alarm horn shall be Audio-Sone #AV-503, or equal. | | |
| 16137 | SPECIAL HARDWARE | | |
| A. | Engraved Nameplates | | |
| | Nameplates shall be provided provided to identify component duty or associated equipment on switchboards, panelboards, starters, switches, fused disconnects, control centers, special panels, etc., and shall be black laminated plastic type with white engraved characters as indicated and shall be fastened with screws. Adhesive attachment methods will not be acceptable. | | |
| B. | Legendplates | | |
| | Legendplates for pilot lights, switches, etc., shall reflect wording shown on the drawings, and shall be non-corrosive metal types fastened by the device locking ring. | | |
| C. | Masonry Inserts | | |
| | Concrete masonry inserts shall be self-driven expansion type Ramset "Red Heat", or equal by Star. | | |
| D. | Padlocks | | |
| | 1. Padlocks shall be outdoor type with case hardened steel hasp, laminated galvanized or cadmium plated steel body, and 4-pin brass tumblers barrel, Master No. 3, or equal. Where equipment is provided with padlocking provisions requiring additional consideration, the Contractor shall provide a similar padlock to that specified herein to suit the requirements of the equipment provided as a part of this work. All locks shall be keyed alike. Padlocks shall be provided on all lockable items including: | | |
| | a. Service Disconnect and Transfer Switches | | |
| | b. Control Panels | | |
| | c. Equipment Enclosures | | |
| E. | Danger Signs | | |
| | 1. Danger signs shall have a white background. Warnings shall be worded as noted on the plans and shall appear in white letters on a red oval inside a black rectangular panel. | | |
| | 2. Non-metallic signs shall be 14" x 10" x 60 mil thick vinyl plastic equal to OSHA 1910.145 as manufactured by Seton, Inc. | | |
| | 3. Steel signs shall be 7" x 10" porcelain enameled steel as manufactured by Standard Signs, Inc., Cleveland, Ohio, and shall be OSHA approved. | | |
| | 4. Unless otherwise noted, Danger Signs shall be fastened with 304 or 316 stainless steel screws. | | |
| | | END OF SECTION 16100 | |
| | | 16100-14 | |

PARTIAL RENOVATION OF LOWER FLOOR
GUNTERSVILLE MUNICIPAL BUILDING
THE CITY OF GUNTERSVILLE, ALABAMA

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| REVISIONS | | |
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| DATE | 08/11/17 | |
| DESIGNED | JIH | |
| BY | JIH | CHECKED |
| SHEET NO. | E-GM-4 | |

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