SAM HOUSTON STATE UNIVERSITY
DESIGN AND CONSTRUCTION STANDARDS

DIVISION 26 00 00
ELECTRICAL

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26 00 00 GENERAL ELECTRICAL

A. This standard is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. The responsibility of the engineer is to apply the principles of this section and the ones that follow so that the Sam Houston State University may achieve a level of quality and consistency in the electrical design of their facilities. Deviations from these guidelines must be justified through LCC analysis and submitted to the University for approval.
B. Refer to 02 10 00 for additional electrical room requirements.
C. Refer to 04 01 02 for applicable codes, standards, and regulations.
D. No electrical gear (panels, transformer, central UPS equipment, etc.) shall be located in MDF/IDF rooms.
E. As-built Requirements
    1. Upon completion of project, set of record electrical drawings shall be kept with mechanical and plumbing record drawings in main mechanical room.
    2. Full size record version of building one-line diagram(s) shall be kept in main electrical room. Provide half-size framed version record one-line diagram mounted on wall in main electrical room at location approved by SHSU
    3. Record drawings shall be kept in PVC tube in rooms noted, show location of this tube on plans.

26 05 13 MEDIUM VOLTAGE CABLE

A. Copper only – no aluminum.
B. 4/0, Copper shield, 90degC, rated at 15kV minimum.
C. Medium Voltage Terminations:
    1. Terminate shielded medium-voltage cables using cable terminators that meet Class 1A
    2. Elbow Terminators:
        a. 200 ampere, loadbreak, equal to Elastimold Type 165LR series with shield terminator with appropriate shield adapt kit.
        b. 600 ampere, non-loadbreak, equal to Elastimold Type 655LR with shield terminator with appropriate shield adapt kit.
    3. Do not use separable connectors to splice cables.
    4. Indoor terminators shall be Elastimold silicone rubber, cold shrink, tubular or skirted.
    5. Outdoor terminators shall be Elastimold silicone rubber, cold shrink, skirted.
D. All cables shall be 3rd party tested per NETA standards and results shown to SHSU for acceptance.

26 05 19 LOW VOLTAGE ELECTRICAL POWER CABLE/CONDUCTORS

A. Stranded Copper only – no aluminum.
B. No AC or BX cable are allowed.
C. MC cable is only allowed for the following:
    1. Use as fixture whips, limited to 6’ in length.
D. 600V rated, minimum.
E. Wire size shall be 12-gauge minimum for all applications except the following:
    1. 14-gauge wire is acceptable for control wiring only.
    2. 10-gauge wire is the minimum for site lighting.
F. Push-in/Stab-in connectors are not allowed.
    1. Exception for light fixture ballast/driver quick disconnects.

G. Color Coding:
   1. 120/208/3: Black (A)/Red (B)/Blue (C); White (N); Green (G)
   2. 120/240/3: Black (A)/Orange (B-HL)/Blue (C); White (N); Green (G)
   3. 277/480/3: Brown (A)/Purple (B)/Yellow (C); Grey (N); Green (G)

26 05 26 GROUNDING & BONDING FOR ELECTRICAL SYSTEMS

A. Building Grounding System: Each building shall be provided with a grounding system with the following:
   1. Service Entrance Grounding Electrode System: Install grounding electrode system as required by NEC. At a minimum, a grounding electrode conductor shall be extended to:
      a. Building metal cold water piping
      b. Structural steel framing
      c. 20 ft of bare copper encased in concrete (Ufer ground)
      d. Ground loop consisting of copper main ground loop and ground rod station with bare copper conductor connect to ground rod stations.
   2. Grounding System Resistance shall be less than or equal to 5 ohms.
   3. Provide a ground bus bar in all electrical rooms and all communication rooms.
   4. Provide separate, insulated equipment grounding conductor for each feeder and branch circuit. Do not use conduit as grounding conductor.
   5. Provide bonding jumper at expansion joints, points of electrical discontinuity, or connection in conduit where firm mechanical bond is not possible, such as flexible connections and insulating couplings.

B. Materials
   1. Grounding and bonding wire
      a. 600V, stranded copper. Solid copper may be used for #8 AWG and smaller. Insulated except where noted bare.
      b. Foundation electrodes: 4 AWG bare, stranded copper
      c. Grounding electrode conductor: Bare, stranded copper
   2. Mechanical Connectors
      a. Bronze connectors, suitable for ground and bonding applications, in configurations required for particular installation.
      b. Bolted connectors for conductors and pipes: Copper or copper allow, bolted pressure-type, with at least two bolts.
   3. Ground Bus
      a. Rectangular bars of annealed copper with insulators to sand ground bus off mounting surface. Minimum size of 12” long by ¼” by 2” in cross section.

26 05 29 HANGERS & SUPPORTS FOR ELECTRICAL SYSTEMS

A. General Requirements
   1. Support raceways using galvanized steel or malleable iron straps, channel, and/or beam/pipe clamps as appropriate.
   2. Install conduit and raceway support and spacing in accordance with NEC.
      a. Provide supports at all boxes, elect equipment, and loads
      b. Provide supports at code required intervals along raceways.

3. Support independent of other systems. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
4. Install multiple conduit runs on common hangers. Provide spare capacity on support elements where more than three conduits are grouped together.
5. Provide housekeeping pads for all floor/ground mounted equipment. Minimum 3 ½" in height, extending at least 4" beyond supported equipment

26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

A. Products
   1. Rigid Metal Conduit (RMC)
      a. Use RMC in all locations where conduit is run exposed and is subject to physical damage.
      b. Use PVC coated RMC in all locations where conduit is exposed to corrosive chemicals, such as near cooling towers.
      c. All underground 90 degree fittings shall be either PVC coated long-sweep 90 degree elbows or taped RMC long-sweep 90 degree elbows.
      d. Use PVC coated long-sweep 90 degree elbows and transition to taped RMC where transitioning up to grade/into building
      e. Use tapped RMC where passing through foundation walls/slabs.
   2. Intermediate Metal Conduit (IMC)
      a. Use IMC for all locations where conduit is run exposed outdoors where not subject to physical damage.
   3. Electrical Metallic Tubing (EMT)
      a. Use EMT for conduit run concealed, and where run exposed indoors and not subject to physical damage.
   4. Flexible Metal Conduit (FMC)/Liquid-tight Flexible Metal Conduit (LFMC)
      a. Light fixture whips shall be FMC and limited in length to 6'.
      b. Use FMC for connections to vibrating or moving equipment. Use LFMC in damp or wet locations, or where deteriorating agents may be present, such as in some mechanical rooms/yards. Minimum length shall be 18 inches, maximum length per the NEC.
   5. Schedule 40/80 PVC
      a. PVC conduit is acceptable for use underground.
   6. Underground Medium Voltage Electrical Concrete Reinforced Ductbanks
      a. Concrete envelope shall have a minimum 30" of cover from final grade.
      b. Where cables enter manholes, handholes, or underground pull boxes, fill the lower rows of ducts and leave the upper rows of ducts spare to facilitate future cable pulls.
      c. Concrete shall have a minimum compressive strength of 2,500 psi at 28 days.
      d. All conduits shall be Schedule 40 PVC.
      e. Steel rebar shall be provided at each corner and rebar stirrups at sizes and intervals for the entire length of the ductbank. Refer to contract drawings for size and intervals. Provide reinforcement at the point where ductbanks enter manhole or building walls. Reinforcement to consist of tape-wrapped hot-dipped RGS conduits extending to a minimum of 10 feet from point of entry into ductbank. Rebar placement shall be per CRSI standards.
      f. All RGS conduit to be tape wrapped.
      g. Bell ends manufactured of ¼" thick fiberglass at the points of penetration/termination and be the same material of the conduit installed.

h. Any bends in excess of 30 degrees shall be RGS conduit.
i. All ductbanks shall have a minimum of 6" concrete around the exterior.
j. Provide factory-fabricated, interlocking, cast-in-place spacers designed to arrange, support, and fix conduits in concrete encasements. Spacers shall interlock vertically and horizontally.
k. All conduits shall have a minimum bend radius of 48".
l. All medium voltage ductbanks shall be integral colored red.

7. Electrical Manholes
   a. Precast concrete electrical manholes 8' x 10' x 8' including thin-wall knockout, pull irons, sump box with grate, ground rod sleeve, fiberglass ladder, ladder up. 1 neck extension and a ring and a ductile iron cover marked "ELECTRIC" cast bin to a 42" diameter precast concrete neck extension X21" high.
   b. Manholes shall have a minimum of a 42" hole opening.
   c. Ladder ups will be mounted in the center of every ladder.
   d. All 600 amp T-bodies and 200 amp elbows will have test points.
   e. All manholes will be clean at the completion of the project.
   f. Stabilizing sand shall be used for installation of all manholes.
   g. A minimum of 10' of rigid conduit with galvanized bell ends shall be required on each duct bank coming in and going out of the manhole.
   h. All conduits shall be cut off flush with the wall in the manholes.
   i. All electrical manhole covers shall be labeled with 'ELECTRIC" on the lid with the Manhole Number "MH-XX" Refer to the drawings for the manhole number.
   j. All cables shall be labeled with feeder number and bldg. numbers, cables should be marked with colored tape to identify the phasing.
   k. All empty ducts coming into manholes shall be provided with pull rope and sealed off.
   l. All fire taping shall be wrapped with cloth taping (3M 77 cloth tape) and be used from duct to termination.
   m. All ducts shall be swabbed before sealing or pulling cable.
   n. All racks shall be as high as possible in manhole.
   o. All racks and arms shall be fiberglass.
   p. Every wall shall have two support racks mounted in order to support cable.
   q. Tie wraps shall be 3' in length and ½" in width.
   r. Manhole lids shall be flush with the paved surface or 4" above final grade if in a non-paved area.
   s. Iron casting for manhole rings and covers shall conform to ASRM A48, Class 30, and be traffic rated.
   t. All manholes shall have a minimum of two 5/8" x 10' grounding rods.
   u. All medium voltage cables in manholes must have a full loop in the manhole whether terminating or passing through.
   v. Where possible and not cost prohibitive, provide 120V power to manhole for maintenance purposes. Coordinate with SHSU facilities during design.

8. Junction Boxes
   a. PVC or Plastic junction boxes shall not be used for under ground installations.

B. Installation Requirements
   1. Minimum Conduit size shall be ¾".
   2. Minimum Conduit size for site lighting shall be 1".

3. All fittings for metallic conduit shall be threaded steel, compression type, or set-screw; diecast fittings are **NOT** acceptable.
4. FMC light fixture whips shall be limited to 6'. MC cable may be used for fixture whips above accessible ceiling.
5. All junction boxes shall be accessible. Provide access panels as required.
6. Conduits routed in slabs shall be limited to branch circuiting feeding cast-in-place floor boxes only. RMC conduit shall be used where turning up into wall. In slab conduits shall not cross expansion joints or penetrate foundation walls.
7. Conduit **shall not** be run in slabs in parking garages.
8. All underground 13,200V circuits shall be run in concrete encased duct banks. Concrete shall be integral colored red.
9. All conduits going between conditioned and non-conditioned space shall be provided with a sealing off fitting on the conditioned side of the space within 6" in the point of entry.
10. Provide a sleeve with water stop for all slab penetrations. Sleeve shall extend at least 2" AFF.

26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

A. Nameplates:
   1. Laminated three-layer plastic with engraved white letters on black contrasting background color, equipment served by generator shall be engraved red letters on red background. Letters shall be ¼" high, minimum. Attach with corrosive-resistant mechanical fasteners, or adhesive.
   2. Install nameplates for the following:
      a. Switchgear
      b. Switchboards
      c. Panelboards
      d. Transformers
      e. Disconnects, starters, and VFDs
      f. Automatic Transfer Switches
      g. Lighting contactors, relay panels, dimmer panels, control panels, etc.
      h. Equipment Enclosures
      i. Control Cabinets and enclosures.

B. Device Labels:
   1. Provide label for all wiring devices (receptacles, light switches, etc.) indicating panel and circuit number serving the device.
      a. Interior locations: Adhesive label, black text on either clear or white background.
         (i) For receptacles intended to serve specific loads requiring constant operation, label receptacle with intended use (i.e. REFRIGERATOR).
      b. Exterior locations: Embossed adhesive tape, white letters on contrasting background.

C. Wire Markers
   1. Install wire marker for each conductor at panelboards, gutter, pull boxes, at electrical equipment and each load connection.
      a. Power and Lighting Circuits: indicate panel name and branch circuit for feeder number, label neutrals with corresponding hot.
      b. Control Circuits: Control wire number as indicated on shop drawings.

D. Raceway Markers

1. Nameplate fastened with adhesive, label fastened with adhesive, or stencil indicating system voltage.
2. Install for each raceway longer than 6 feet and rated 100A or more. Provide marker in a visible location in each room where raceway passes through walls or floors in equipment rooms, and where located above accessible ceilings. Coordinate labeling where conduit is run exposed in finished areas with owner and architect.

E. Junction & Pull Box Labeling
   1. Label all junction and pull boxes with the panel, circuit number, and voltage with permanent marker or printed label.
      a. Exposed boxes in finished spaces shall be labeled on the inside of the box cover.
      b. Boxes for electrical shall be provided with color coded covers as follows:
         (i) Blue – Normal 120/208 Power
         (ii) Yellow – Normal 277/480 Power
         (iii) Pink – Emergency/Critical 120/208 Power
         (iv) Orange – 277/480 Emergency/Critical Power
      c. Boxes for communications, fire alarm, and access control shall be provided with color coded covers as follows:
         (i) Access Control: Green
         (ii) Fire Alarm: Red

F. Underground Warning Tape
   1. Provide plastic tape, detectable type (metal backed or with embedded tracer wire), colored red with suitable warning legend describing buried electrical lines.
   2. Install along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above underground conduit, raceway or cable.

G. Posted Operating Instructions

H. Equipment Clearances
   1. Paint required clearances on floors in front of panels/equipment.

26 05 73 ELECTRICAL SYSTEM STUDIES

A. General Requirements
   1. Software: SKM Power Tools

B. Short Circuit Fault Current Study.
   1. Calculate the maximum available short-circuit current in amperes rms symmetrical for a three-phase bolted fault at each of the following:
      a. Switchgear and switchboard bus.
      b. Medium voltage controller
      c. Motor control center
      d. Distribution panelboard
      e. Branch circuit panelboard

C. Protective Device Coordination Study
   1. Prepare written report indicating the following results of coordination study.
      a. Tabular Format of settings selected for overcurrent protective devices
         (i) Device tag
         (ii) Relay-current transformer ratios; and tap, time-dial, and instantaneous pickup values
         (iii) Circuit breaker sensor rating; and long-time, sort-time, and instantaneous settings.

(iv) Fuse current rating and type
(v) Ground fault relay pickup and time delay settings.

b. Coordination Curves: Graphically illustrate that adequate time separation exists between deices installed in series. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
(i) Device tag.
(ii) Voltage and current ratio for curves.
(iii) Three-phase and single-phase damage points for each transformer.
(iv) No damage, melting, and clearing curves for fuses.
(v) Cable damage curves.
(vi) Transformer inrush points.
(vii) Maximum fault-current cutoff point.

2. Contractor shall set all adjustable breakers per the report.

D. Arc Flash Hazard Analysis Study
1. Perform arc flash calculations using the equations describe by either NFPA 70E or IEEE Standard 1584.
2. Labels shall be produced based on the results and field installed on the equipment. Labels shall be machine printed, with no field markings. Labels shall include the following information:
a. Equipment Designation
b. Nominal voltage
c. Flash protection boundary
d. Incident energy
e. Working distance
f. Engineering report number, revision number, and issue date.
3. Labels shall be installed by the contractor

26 22 13 LOW VOLTAGE DISTRIBUTION TRANSFORMERS

A. Product Requirements.
1. K-Rating
a. Minimum K-rating for general purpose transformers shall be K-4.
2. Copper winding preferred.
a. Aluminum winding allowed for general purpose K-4 transformers where non-linear load types do not make up more than 25% of transformer connected load.
b. Aluminum winding allowed for K-7 rated transformers where non-linear loads types do not make up more that 50% of transformer connected load.
c. Aluminum windings allowed for K-20 rated transformer where non-linear loads types exceed 50% of transformer connected load.

B. Installation requirements
1. Floor mounted transformers shall be provided with concrete housekeeping pad.
2. All transformers shall be provided with isolation pads.

26 23 00 LOW VOLTAGE SWITCHGEAR

A. General
1. All building service entrance equipment rated at more that 1200A shall be switchgear.

B. Construction
   1. Metal Enclosed Distribution Switchgear. ANSI C37.15 / UL1066, draw out mounted, power circuit breakers.
   2. Copper bussing.
C. Manufacturer
   1. Square D
   2. ABB/GE

26 24 13 SWITCHBOARDS

A. General
   1. Switchboards may be used for secondary distribution within buildings.
   2. Switchboards may be used as service entrance equipment if building service is less than 1200A.
B. Construction.
   1. NEMA PB 2, free standing, dead front, enclosed switchboard.
   2. Individual mounted Main, group mounted distribution.
   3. Copper bussing with fully rated copper neutral.
   4. Bolted connections, accessible from the front.
   5. Main breakers and distribution breakers rated 800A or more shall be provided with solid state trip units with adjustable trip settings.
C. Manufacturer
   1. Square D
   2. ABB/GE

26 24 16 PANELBOARDS

A. General
   1. Use of feed-thru lugs shall be limited to multi-section panelboards.
      a. Use may be allowed with prior Owner approval.
   2. Use of sub-feed panels should be limited to two levels downstream of a transformer.
B. Construction.
   1. Door-in-door construction with inner door hinged to allow breaker access.
   2. Door locks.
   3. Copper bussing
   4. Bolt-on breakers
C. Manufacturer
   1. Square D
   2. ABB/GE

26 24 19 MOTOR CONTROL CENTERS

A. Construction
B. Manufacturer.
   1. ABB/GE.
   2. Square D

26 25 00 ENCLOSED BUS ASSEMBLIES

A. Construction.
   1. Busway
      a. NEMA BU1.
      b. All copper bussing.
      c. Full copper neutral bus
      d. Insulated copper ground bus
   2. Feeder Plug-in Units
      a. Switching and overcurrent protection in enclosure with hinged door and externally operable handle, lockable in the OFF position, insulated grounding stab.
      b. May utilize molded case thermal-magnetic circuit breakers or fusible switch assemblies.
B. Manufacturer: All components of the system shall be by a single manufacturer
   1. ABB/GE
   2. Square D

26 27 13 ELECTRICITY METERING

A. Coordinate locations of sub-meters and requirements with SHSU. As a basis of design, include submetering for HVAC equipment.
B. Preferred Meters
   1. Electro Industries 100- series Shark meter.
   2. Schneider Electric meters when provided integral to equipment
C. Communication Requirements
   1. BACnet
   2. Controls contractor to tie meter into campus system to allow reporting to campus Schneider Electric Power Monitoring Expert software.

26 27 26 WIRING DEVICES

A. General requirements
   1. Push-in, screwless pressure terminal connections are **NOT** allowed.
   2. GFCI protection for water fountains shall be provided at the circuit breaker.
   3. Provide dedicated, NEMA 5-20R simplex receptacles with stainless steel faceplates in hallways for cleaning. Space so that no point in hallways is more than 50’ from an outlet. These hallway outlets shall be on dedicated circuits.
   4. Circuiting of computers/workstations shall be limited to a maximum of 3 per 20A circuit.
   5. Controlled receptacles shall be placed generally as follows:
      a. Private Offices: At desk wall, double-duplex receptacle with one duplex being constant on, and one being controlled. All other walls shall use split wire duplex receptacle (constant on/controlled).
      b. Other Required Locations:
         (i) Work with space design team and SHSU to provide layout to meet space user needs.
         (ii) For receptacles intended to serve specific loads requiring constant operation, label receptacle with intended use (i.e. REFRIGERATOR).
   6. Unless noted otherwise, Basis of Design manufacturer for all wiring devices shall be Hubbell.
B. Receptacles.

1. Minimum 20 ampere rated, extra heavy-duty industrial or hospital grade.
2. All outdoor receptacle shall be weather resistant type.
3. All outdoor while-in-use receptacle covers shall be heavy duty metal. Plastic covers are not allowed.
4. Controlled receptacles shall be permanently marked with universal power symbol and the word "CONTROLLED". Use of stickers for marking is not acceptable.
5. Install with ground pointed to floor.
6. Receptacles served by generator shall be red in color.

C. Light Switches.
1. Minimum 20 ampere rated, toggle type.
2. Rocker/decora type switches are not allowed.
3. Electronic Low Voltage (24V) switches are acceptable.

D. Wallbox Dimmers
1. Solid-state design with flicker noise control.
2. Basis of Design Products:
   a. Lutron Nova T Series

E. Res Life Projects
1. Receptacles
   a. All receptacles shall be Tamper Resistant Type per NEC requirements.
   b. 15A devices are allowable within dwelling units on multi-outlet branch circuits. All receptacles in common areas shall be 20A rated minimum.
2. Light Switches
   a. 15A devices are allowable within dwelling units.
3. Wallbox Dimmers
   a. 15A devices are allowable within dwelling units.

26 28 16 ENCLOSED SWITCHES & CIRCUIT BREAKERS

A. Disconnect Switches.
1. Heavy duty type fused and non-fused, enclosed switches only.

B. Enclosed Circuit Breakers.

C. Enclosure Ratings.
1. NEMA 1 – indoor, dry locations.
2. NEMA 3R – outdoor, wet locations.
3. NEMA 4X – outdoor, wet locations where corrosion resistance is required.
   a. Cooling tower equipment areas.
   b. Lab exhaust areas.
   c. Swimming pool equipment areas.

26 29 00 LOW VOLTAGE MOTOR CONTROLLERS

A. Refer to 23 05 13 for Variable Frequency Drive requirements.

26 32 13 ENGINE DRIVEN GENERATOR SETS

A. Emergency System General Requirements.
1. Fire Pumps shall be connected to the emergency system per IBC and NFPA requirements.

2. Outdoor pad mounted generators shall be provided with a sound attenuated enclosure. Sound attenuation shall reduce sound pressure level to a maximum of 72dBA average at 23 feet. Sound attenuation level may include external attenuation, such as screen walls. For remote locations, higher sound levels may be approved by SHSU on a case-by-case basis.
3. All generators shall be provided with a dual purpose docking station to allow for quick connection of portable load bank for testing, and for connection of a temporary roll up generator.
4. Emergency loads shall be grouped into three branches per the NEC. Each branch shall be provided with its own automatic transfer switch.
    a. Emergency (NEC 700)
        (i) Exit Signs and means of egress illumination.
        (ii) Elevator car lighting
        (iii) Fire Alarm/Detection systems & Emergency communication systems
        (iv) Electric Fire Pumps
    b. Legally Required Standby (NEC 701)
        (i) Ventilation for smokeproof enclosures
        (ii) Smoke removal systems
        (iii) Elevators
    c. Optional Standby (NEC 702)
        (i) Communications
        (ii) HVAC for critical areas
        (iii) Food Service refrigeration equipment
        (iv) Critical equipment/areas as directed by SHSU
5. Remote annunciator shall be provided in the main emergency electrical room near ATS(s), and in fire command center for high rise buildings.

B. Engine Generators
1. The engine shall be a four-stroke engine, and rated for emergency service at 480Y/277 Volts, grounded-wye, 60 Hz unless otherwise specified and discussed with SHSU.
2. The engine-generator set shall be rated not less than specified kW/kVA at 0.8 power factor on an emergency basis. The AC synchronous generator shall be rated 60 Hz, 4 pole, revolving field, 1800 RPM for use with a 208Y/120 or 480Y/277 VAC, 3 phase, 4 wire electrical system. The alternator shall be oversized and rated for at least 125% of the specified kW/kVA at 80 degree rise for non-linear load considerations.
3. The engine-generator set shall be capable of picking up a minimum of 100% nameplate and connected kW and power factor, less applicable de-rating factors, in one step with the unit at operating temperature.
4. The engine-generator set shall have a motor starting or surge KVA capability of three times the rated KVA based upon a recovered sustained RMS voltage drop of no more than 10% of no load voltage with the specified load kVA at or near zero power factor. Maximum instantaneous voltage dip shall not exceed 30% at this load and power factor level. If associated with serving a fire pump, the maximum dip shall not exceed 15%.
5. Fuel
    a. Natural gas is preferred fuel source.
    b. Diesel is acceptable where natural gas is not available, or where a natural gas engine cannot meet project requirements.
        (i) System must be designed to allow for refueling from street level.

(ii) Provide with fuel tank sized for a minimum of 24 hours of operation without refueling. Confirm with owner if longer run time is required for project

6. Acceptable Manufacturers:
   a. Kohler Power Generation
   b. Cummins/Onan
   c. Caterpillar
   d. Owner approved equivalent.

C. Docking Station
   1. All generators on new buildings shall be provided with a dual-purpose docking station to allow:
      a. The connection of a temporary generator in event permanent generator is out of service.
      b. The connection of a temporary load bank for testing of permanent generator.
      c. If space limitations do not allow for a dual purpose docking station, an alternate method of compliance with NEC 700 temporary alternate source requirements may be used with prior Owner approval.
   2. Generators added to existing buildings being used to serve Emergency (NEC 700) loads shall be provided with at a minimum a temporary docking station to allow for the Emergency transfer switch to be served from a temporary roll-up generator.
   3. Provide with load dump receptacle to allow for automatic shedding of load bank in the event of loss of utility power during generator testing.
   4. For all new buildings or major renovations of existing buildings not provided with permanent emergency generator, or for buildings with only partial generator backup, coordinate with owner if docking station should be provided for temporary roll-up generator to power additional loads.

26 33 53 STATIC UNINTERRUPTIBLE POWER SUPPLY

A. Refer to IT at SHSU A&E guidelines for requirements.

26 36 00 TRANSFER SWITCHES

A. General Requirements
   1. Emergency/Life Safety branch (NEC 700) loads shall be served by maintenance bypass automatic transfer switches.
   2. UL 1008 listed.
   3. Provide remote annunciator, coordinate location with owner.

B. Manufacture
   a. Same manufacturer as Generator.

26 41 13 LIGHTNING PROTECTION FOR STRUCTURES

A. Provide Facilities with Lighting Protection system.
   1. All components, materials, devices, and accessories shall be UL 96 listed and labeled.
   2. All work shall be performed in accordance with NFPA 780 and UL 96A
   3. Furnish with UL Master Label

26 43 13 SURGE PROTECTION FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

A. Provide Type 1 SPD at building service entrance equipment. SPD shall be connected in parallel with the service equipment.

B. Provide Type 2 SPD at branch panels serving the following load types.
   1. IT equipment.
   2. Panels serving any equipment located on building exterior.
   3. All Emergency branch panels.

26 51 00 INTERIOR LIGHTING

A. General Requirements
   1. All luminaires shall be Design Lighting Consortium (DLC) listed, latest edition.
   2. Do not use high intensity discharge (HID), fluorescent, or standard incandescent lamps.
   3. Utilize LED fixtures for all specialty lighting, under counter and exterior lighting.
   4. No custom design lighting.
   5. Lighting control system shall be integrated into BAS.
   6. Daisy chaining light fixtures is not allowed.
B. Controls
   1. All lighting controls shall be Design Lighting Consortium (DLC) listed, latest edition.
   2. Wireless controls shall not be used for new construction.
   3. In renovation/expansion projects, wireless controls may be allowed for specific uses where wired controls are not feasible. PSP shall obtain approval from SHSU on use prior to including in design.
   4. In renovation/expansion projects, the manufacturer of existing to remain lighting controls shall be used for areas within the project scope.
C. Required Light Levels
   1. Per IESNA recommendations
D. LED Lighting
   1. General requirements
      a. 0-10V dimming; dimmable to at least 10%
      b. 4000K color temp
      c. 3000K color temp for Res Life living areas
      d. Minimum 80 CRI
      e. 5 year minimum warranty
   2. Exit Signs
      a. Fixtures shall be LEC or LED, hard wired, perimeter lit and red on clear background type.
      b. If a back-up circuit is not available, then exit sign must be a battery back-up type with self-diagnostics that shall perform both 30-day and annual 90-minute tests with LED indication.
   3. Campus Standard LED light fixtures
      a. General requirements
         (i) 0-10V dimming; dimmable to at least 10%
         (ii) 4000K color temp
         (iii) Minimum 80 CRI
         (iv) 5 year minimum warranty
      b. 2x4 Lay-in Troffer
         (i) CREE CR2440L94010V or ZR2440L84010V5UNV (Basis of Design)
         (ii) Approved equals by SHSU via substitution request.
      c. 2X2 Lay-in Troffer
         (i) CREE CR2232L94010V and ZR2230L84010V5UNV (Basis of Design)

(ii) Approved equals by SHSU via substitution request.

d. 2x4 Lay-in Flat Panel
   (i) CREE C-TR-C-FP22-37L-40K-WH (Basis of Design)
   (ii) Approved equals by SHSU via substitution request.
e. 2x4 Lay-in Flat Panel
   (i) CREE C-TR-C-FP24-50L-40K-WH (Basis of Design)
   (ii) Approved equals by SHSU via substitution request.
f. Recessed Can Light Fixtures
   (i) Similar to F-Class Commercial V4OFCR Series with accessible driver or have drivers mounted in remote accessible location for maintenance.

E. Emergency Lighting
1. For Buildings with an emergency generator, all emergency lighting shall be served from generator.
2. For Buildings without an emergency generator, all emergency lighting shall be served from an emergency lighting inverter system. System may consist of a single centralized inverter or multiple de-centralized inverters. Refer to Inverter section for specific requirements.
3. For renovation/expansion projects in buildings which do not have an emergency generator or inverter, emergency lighting fixtures similar to a Cooper CU2 fixture are acceptable.

F. Emergency Lighting Inverters
1. Central Emergency Lighting Inverters
   a. Provide central inverter system for all buildings not provided with an emergency generator.
   b. Minimum 90-minute run time.
   c. Minimum 20% spare capacity.
   d. Self-testing/diagnostics.
   e. Inverters in new buildings or whole floor/building renovations shall be capable of self documenting required testing results.
   f. Preferred Manufacturers
      (i) Emergi-Lite
   g. Locate in main electrical room or a dedicated emergency inverter room.
   h. Provide start up and commission from factory authorized technician.

G. Installation Requirements
1. Applications other than standard general purpose lighting require presentation to the University. Use of specialty lamps requires prior University approval. Minimize the number of different lamp types used.
2. Outlet boxes for lighting shall be 4” square or 4” octagon boxes mounted to the structure. These boxes may feed up to 4 light fixtures individually so that each fixture can be taken out of service without affecting the remainder of a circuit. Do not daisy chain light fixtures.
3. Stairwell light fixtures shall be located such that they may be reached safely with no more than an 8- foot ladder.
4. All drivers and other serviceable parts of fixtures mounted in hard-lid ceilings shall be accessible from below. If fixture housing does not allow for easy maintenance access from below, drivers shall be remote mounted at a location where accessible via access panel or accessible ceiling type.

26 56 00 EXTERIOR LIGHTING

A. General Requirements

1. All luminaires shall be Design Lighting Consortium (DLC) listed, latest edition.
2. Do not use low pressure sodium or standard incandescent lamps.
3. Utilize LED fixtures for all exterior lighting.
4. No custom design lighting fixtures.
5. 5000K color temp
6. Follow fixture types shall not be used without prior owner approval:
   a. Low voltage fixtures requiring remote power supply
   b. In-grade lighting
   c. Stairwell step lights
   d. Handrail lighting
7. All exterior lighting to be controlled by one astronomical time clock. Preferred time clock is an Intermatic ET2805CR.
8. All pole lights are required to be independently grounded via a ground rod or steel cage.

B. Required Light levels
   1. Pedestrian walkways and parking lots: 2FC min
   2. Other / Not Listed: Per IESNA recommendations

C. LED Approved Manufacturers EXTERIOR lighting:
   a. Area and Parking Lot Luminaires: (NO EXCEPTIONS without prior approval)
      (i) CREE - BETA LED Area Lighting Fixture: LED Area Lighting "The Edge" Type V-short Model #: Beta LED# ARE-EDG-5S-R3-24-E-UL-BZ-350
      (ii) Spec: LED minimum Type V short 6000k 263ci Lumens, Voltage: 120-270, Wet Location listed, Color: Dark Bronze
      (iii) Parking Lot Pole:
         (a) United Lighting Standards 30'
         (b) Model # SSHP-30-6-7-T2-TMB
         (c) Specs: 6" Square steel pole, height 30'
            (i) Provided hinged poles when located on top level of parking garages
   b. Pedestrian Walk, Plaza Light Standard (NO EXCEPTIONS without prior approval)
      (i) CREE - BETA LED Fixture: The edge Round Luminaire
      (ii) Model# ARE-EDR-5M-R5-06-E-UL-BZ-350
      (iii) Spec: LED, minimum 5,250 lumens voltage 120-270, wet listed Color: Dark Bronze.
      (iv) Walkway Pole:
         (a) United Lighting Standards 12' Aluminum Pole
         (b) Model # RSHA-1521-T2-DB
         (c) Specs: Round hinged Aluminum pole, height 12', shaft OD 5" Color: Dark Bronze
   c. Wall Packs
      (i) CREE – BETA LED Fixture: The Edge LED Wall Pack
      (ii) Model # SEC-EDG-3M-WM-04-E-UL-BZ-350-40K
      (iii) Spec: LED, minimum 3,343 lumens, Voltage: 120-277, Wet location listed, Color: Dark Bronze
   d. Parking Garage
      (i) XtraLight Architectural Canopy Light
      (ii) Model # ACL-x-xxxL-4000K-DIM-T5-GY
      (iii) Spec: LED, minimum 3,000 lumens, Voltage: 120-277, Wet location listed, corrosion resistant, Color: Gray
   e. Exterior Canopy Lighting

(i) XtraLight Vapor Tight Slim Linear LED
(ii) Model # VTS-4-xxxxL-40K-DIM-SFA-
(iii) Spec: LED, minimum 3,000 lumens, Voltage: 120-277, Wet location/IP67 listed, corrosion resistant, Color: Gray
(iv) Parking Garage type fixture may also be used for canopy applications.
(v) Installation Requirements: All conduit shall be routed below roof; either within canopy structure of surface mounted below. In no case shall conduit be routed on top of canopy.

D. Product Requirements:
1. The performance criteria is the same as interior luminaires plus the additional or "in lieu of" criteria below:
a. CRI shall be ≥70.
b. Shall be durable, corrosion resistant fixtures that are readily maintainable and have minimal luminaire O&M costs
2. The luminaire descriptions are to establish design intent and to set a standard of quality. All luminaires shall be UL listed for wet or damp locations depending on the application.

E. Installation Requirements
1. Exterior lighting should be accomplished using lighting standards and wall packs.
2. Alternate lighting solutions shall be considered when standard light methods are not adequate. All such instances shall be approved by SHSU Electrical Services.