Division 26 00 00 - Electrical

26 00 00 General Requirements

1. Refer to Part 3.1.5.5.6 of this manual for General Electrical Design Criteria.

26 05 19 Low-Voltage (600V and below) Electrical Power Conductors and Cables

1. All conductors 250 KCMIL and larger can be aluminum installed per NEC, all other conductors shall be copper. All power conductors shall be awg #12 or larger. Minimum control wire shall be AWG #14 and minimum signal wire size no smaller than AWG #22.
2. Wire for low voltage circuits shall be single conductor stranded copper (solid for #12 and smaller) of not less than 98% conductivity with 600 volt, Type THHN/THWN insulation. Type XHHW may be used for sizes #2AWG and larger.
3. Wire and cable No. 10 AWG and smaller, shall be made with approved insulated indentation or spring insert type pressure connectors. Connections and splices in low voltage wire, No. 8 AWG and larger, shall be made with approved insulated spring insert type pressure connectors or bolted or compression-crimped type pressure connectors covered with an insulating filler tape, "Scotch-fil", or approved equal, and two half-lap servings of vinyl electrical tape, Scotch #33 or approved equal. All taped connections exposed to weather or moisture shall be given two coats of weatherproof insulating paint, Okonite, or approved equal.
4. All conductors shall be color-coded where visible and numbered and tagged to each junction box, pull box, panel and device with suitable fireproof tags or adhesive identification bands. Color-coding of conductors for power and branch circuits shall be as follows:

For 120/208 Volt System	For 277/480 volt System
Phase "A": Black	Phase "A": Brown
Phase "B": Red	Phase "B": Orange
Phase "C": Blue	Phase "C": Yellow
Neutral: White	Neutral: Grey
Ground: Green	Ground: Green

5. Feeder sizes and protections shall not be such a large percentage of the main that coordination of devices cannot be achieved.
6. Use two wire circuits with individual neutral conductors for all branch receptacle circuits in administrative, office, computer laboratory and classrooms, and general laboratory areas.
7. Refer to Part 3.1.5.5.6 for Branch Wiring Criteria.

26 05 13 Medium Voltage (600 ~ 15000V) Cables

1. Provide testing of the feeder cables per NETA-ATS and furnish Mason with a copy of the completed test report prior to equipment startup.

2. All cable in manholes shall be wrapped in two "opposing layers" of fireproofing tape secured in place with glass-cloth binder type. Slack cable shall be provided in manholes by routing the cables by the longest path possible through the manholes.
3. All cables in manholes shall be properly supported on cable supports a minimum of every 36". Provide new cable supports in existing manholes as required for proper support of both the new and existing cables.
4. High voltage cables shall be terminated in accordance with the cable manufacturer's recommendations using terminators specifically recommended by the type of cable specified.
5. Terminations and splices shall be performed by a certified experienced cable splicer. Taped "T" splices are not permitted; they will be made using elastimold, or approved equal, disconnectable fittings.
6. Cables shall be identified in manholes as to source and destination.
7. Testing: DC proof testing on high voltage and medium voltage cabling systems including primary / secondary, MCC, motors, etc. Test results to be included in O & M Manual.

26 05 26 Grounding and Bonding for Electrical Systems

1. Provide testing of the ground systems per NETA-ATS 7.13 and furnish Mason with a copy of the completed test report prior to equipment startup.
2. Ground connections that are permanently concealed shall be made by the exothermic process to form solid metal joints. Accessible ground connections shall be made with mechanical pressure type connectors.
3. Grounding conductor in raceways shall be 600 volt green insulated copper conductor sized per NEC code. The neutral bar of the panel shall not be used for equipment grounds.
4. Where concentric knock outs are used on panels or cabinets the paint needs to be removed to ensure metal to metal contact or a bonding bushing is to be used. This includes switchboards, panelboards, cabinets, transformer neutral, transformer ground pad, motor frames, motor starters, lighting fixtures, lightning arresters, conduit systems, and all non-current carrying metal parts of electrical equipment. Steel frame buildings shall be grounded through a low resistance ground system.
5. Convenience outlets shall have a wired ground for continuity of ground path from the device grounding pole.
6. Provide an 8’ deep copper-clad driven ground rod at outdoor lighting poles for equipment grounding, and provide an equipment ground wire in PVC underground conduits to the poles per NEC.
7. A system ground shall be provided for each separately derived system including service entrance, each voltage level, and generators per NEC.
8. An isolated ground shall be provided where required for designated sensitive electronic equipment in any facility. An isolated ground bus must be provided in the source panel and connected back to the service ground point by an identified insulated ground conductor per NEC.
9. Grounding shall be per UL 467. Bare grounding conductors shall be stranded copper grounding. Bus shall be predrilled rectangular copper with stand-off insulators.

26 05 33 Raceway and Boxes for Electrical Systems

1. MC type cable is acceptable for electrical and fire alarm concealed applications such as walls and ceiling. Installation and support of the MC type cable shall comply with current NEC.
2. Minimum conduit size shall be ¾”. All empty conduits shall have a 65-lb. test polymer (or equivalent) pull string tied off at both ends.

3. Galvanized rigid steel conduit shall be hot-dipped galvanized steel inside and outside comply with UL Standard 6, Federal Specification WW-C-581-D and ANSI C 80.1. Galvanized rigid steel conduit can be used for the following:

    - Buried raceways in concrete slabs (except for main services which shall be PVC conduit concrete encased ductbank) or in the ground. Where directly buried, two coats of asphaltic compound shall be applied.
    - Interior high voltage runs.
    - Exposed exterior raceways.
    - Any raceway in hazardous areas.

        1) Termination of ductbank runs through concrete and into equipment or indoor areas.

4. Electro-Galvanized Steel Metallic Tubing (EMT) shall comply with UL Standard 797, Federal Specification WW-C-563 and ANSI C 80.3. EMT can be used for the following:

    - Interior branch circuits that are exposed.
    - Interior exposed feeders.
    - Interior exposed motor circuit wiring.
    - Interior exposed control, Fire alarm, signal and sound wiring.
    - Use compression fittings only. Set screw type fittings are unacceptable. All fittings shall be steel.

5. Rigid Plastic Conduit, Schedule 40 PVC, can be used for the following:

    - Underground primary or secondary service ductbank encased in red concrete, rigid galvanized steel elbows shall be used where the conduit is run through concrete slab. Also a separate grounding conductor with green insulation shall be provided in these runs.
    - Underground telephone service ductbank encased in concrete.
    - Lightning protection down leads, and individual ground conductors.
    - Interior branch circuits that are exposed in wet or caustic environments.
    - Interior exposed feeders in wet or caustic environments.

6. Underground ductbank runs shall be installed minimum of 30" below grade to top of bank, wherever possible. If 30" is not possible, concrete encased ducts may be installed to minimum burial depth stipulated in NEC. Underground runs cable markers shall be installed for all direct-buried cables and cables in non-metallic and metallic raceways. Marker shall be located directly over buried lines at 8 to 10 inches below finished grade. See also 02580.
7. Liquid-Tight Flexible galvanized steel conduit with continuous copper bonding conductor shall be used for connection, not exceeding 5' in length, to all motors, heating and ventilating controls, and at other locations where vibration, movement, moisture, or oil-vapor atmosphere are encountered.
8. Hot-Dipped galvanized, single strip flexible steel conduit, not exceeding 6' in length shall be used for connections and chain hung lighting fixtures.
9. Plastic jacketed rigid steel galvanized conduit shall be used in corrosive atmospheres.
10. Rigid aluminum conduit may be used in lieu of rigid steel conduit, except where in contact with or in earth, concrete or masonry.

11. Conduit shall be 3/4" size minimum. Flexible steel conduit of 1/2" diameter may be used for connections to be recessed and chain hung lighting fixtures.
12. Where empty conduits are required to be installed, provide a continuous #12 nylon draw line with identification tag securely attached to both ends. The tags must clearly identify location of other end of empty conduit.
13. Suitable expansion and deflection fittings with grounding continuity shall be provided in each conduit run at each point where the conduit run crosses a building expansion joint.
14. All wiring shall be installed concealed in ceilings, walls, slabs, pipe chases and furred spaces whenever possible. Conduit may be installed exposed only in Mechanical Room, Electrical Room and Janitors Closets. Concealed conduit shall be installed in a direct line, with bends as long as practicable. Exposed conduit shall be installed parallel to or at right angles with the lines of the Building, as closely as possible to walls, ceilings, columns and other structural parts, consistent with proper space for access to boxes and so as to occupy a minimum of space. Where exposed conduits are grouped, they shall be run parallel and equally spaced with matching bends.
15. Surface metal raceways with snap-on covers shall be used for exposed runs in finished areas, for counter and workbench power and data outlets where required. Acceptable manufacturers are Wiremold, Mono-systems and Isoduct.
16. Pull and junction boxes shall be of ferrows alloy. Cabinets shall be galvanized steel with hinged cover.

26 11 00 Substations

1. Type and Location of Building Substations:

    - Outdoor compartmental type pad mounted, completely enclosed, liquid filled power transformer with load break primary disconnect, or two "on-off" load break disconnects for loop feed service where required by campus distribution, primary fuses and lightning arresters may be used to serve the building. This shall be located close to building electrical equipment room to keep secondary runs from outdoor transformer to indoor main distribution switchboard as short as possible. Main power distribution switchboard shall be located in building electrical room, NEMA 1 construction. The secondary power distribution switchboard shall be similar to that below for indoor units.

    - Indoor unit substation shall consist of a load break primary disconnect, or two "on-off" load break disconnects for loop feed service where required by campus distribution system, primary fuses, primary lighting arresters; dry type ventilated power transformer; and main secondary power distribution switchboard. Unit substations shall be provided as a completely enclosed, integrated and coordinated line-up by the manufacturer. The two primary "on-off" load interrupter switches for loop feed shall be in individual vertical section connected together on the load side and key interlocked to prevent both incoming circuits from being connected to transformer at the same time. Primary sections shall be equipped with copper ground bus. Incoming primary service shall be underground wherever possible. Primary fuses shall be disconnect type S & C type SM5, or approved equal. Dry-type ventilated transformer to have maximum temperature rise of 115^{o} C. above a 40^{o} C. maximum ambient, to be equipped with provisions for forced cooling, to have 4 - 2-1/2 full capacity taps in high voltage winding 2 above and 2 below normal, and ground pad. Main secondary switchboard shall be front accessible, with vertical sections as required bolted together to form one metal enclosed rigid switchboard constructed to NEMA PB-2 and UL 891 standards. It shall be equipped with Owner's metering section with an ammeter and selector switch, voltmeter and selector switch and KWHR meter demand attachment. Unit shall have a main circuit breaker, and feeder branch circuit breakers as required to serve loads plus two spare feeder breakers. Rating of main bus, circuit breakers, etc. shall be determined based on building transformer rating and building distribution system to serve loads. Interrupting capacity shall be determined and noted on system one line diagram main buses and equipment. Provide a ground copper

bus in switchboard for its entire length firmly secured to each vertical section. Provide space for future breakers. Incoming secondary service shall be underground wherever possible. Breaker loading shall be a maximum of 80% of its rating unless breakers are specified and available as fully rated units for switchboard service. Each breaker on the switchboard assembly shall have an engraved lamacoid nameplate to designate load served.

26 24 16 Panelboards

1. All panelboards and Motor Control Centers will tested in accordance with NETA-ATS 7.1 and a copy of the test report will be furnished to Mason prior to equipment start-up.
2. All panelboards shall be rated for the intended voltage and shall be in accordance with Underwriter's Laboratories, Inc., standards for panelboards and standards for cabinets. Panelboard boxes shall be so labeled.
3. Panels shall consist of factory completed dead-front assemblies of sheet steel cabinets, main buses, over-current and switching units and sheet steel trim.
4. Boxes shall be 20 inches wide and fabricated from unpainted, galvanized code gauge sheet steel having multiple knockouts with lapped and screwed or welded corner construction. Boxes shall be of sufficient size to provide a minimum gutter space in accordance with NEC Tables 373-6(a) and (b), but not less than four inches at the side and six inches at top and bottom. Multi-section panelboards shall be provided with a minimum top and bottom gutter space of 8 inches. Where feeder cables supplying a panel are carried through its box to supply other panels the box shall be provided with a separate barriered side gutter. Cables shall be bundled, routed and supported within the gutters. This wiring space shall be in addition to the minimum gutter space specified above. A minimum of four interior mounting studs shall be provided.
5. Trims shall be fabricated from code gauge galvanized sheet steel. Trims shall be fastened to cabinets by means of machine screws with captive nuts or clamps and shall be self-supporting on the cabinet after trim holding screws have been removed. Trim for flush panels shall overlap its perspective box by at least 3/4 inch all around. Surface trim shall have the same width and height as its respective box. Doors and trims shall each be in one piece so designed that door will close without a rabbet.
6. Panel doors shall be fabricated from the same material as the panel trim and shall be fastened thereto by continuous concealed hinges. Doors shall be so installed that no live parts are exposed when the door is opened. Doors shall be complete with flush type combination lock and catch with keys. Doors over 48 inches high shall be provided with vault handle, built-in locks and three point catch fastening door at top, bottom and centers. All panels shall be keyed alike. Doors shall be provided for access to contactors, time clocks, relays, and similar devices as required.
7. Backbox interiors, inside trim, door and exterior shall be treated with a rust inhibiting phosphatized coating after pickling and finished in ANSI-61 gray enamel. A typewritten directory, eight inches by ten inches, with metal frame and clear plastic face shall be furnished and installed upon the inside of the door of each panelboard, indicating the room or area and the service controlled by each circuit.
8. Bus bars shall be hard drawn copper and extend the full height of the panel without reduction. Buses shall be arranged for sequence phasing of branch circuits. Circuit loading shall be distributed evenly over all phases. The neutral bus shall have a suitable lug for each outgoing branch circuit requiring a neutral connection. Neutral bus shall be full size and electrically isolated from the cabinet. Ground bar shall be bare uninsulated and suitable bolted to the cabinet for equipment grounding. Busing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Bracing shall be equivalent to, or compatible with, the rated interrupting capacity of the smallest overcurrent device in that panelboard. Spaces for future devices shall be bussed for the maximum device that can be fitted into them with suitable insulation and bracing to maintain proper short circuit rating. All provisions shall be made for ready insertion of future protective devices. Provide an isolated ground bus where required by special sensitive equipment.

9. All interiors shall be completely factory assembled with switching and protective devices, connectors, etc. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping. Branch circuits shall be arranged using double row construction.
10. Multiple section panels shall have feed-thru lugs with full capacity taps to adjacent panel sections.
11. Lighting and power panels for 480Y/277 volt system and receptacle, appliance and power panels for 208Y/120 volt system shall be of the bolted circuit breaker type with single, two and three pole branches of quantity and trip setting as required. Panelboards shall be furnished with main overcurrent interrupting devices consisting of circuit breakers of size and capacity as required.
12. Multiple cable lugs for incoming feeder cables shall be furnished where required. Lugs shall be secured to bus by stud bolts. Where several panels are fed by one feeder, solid tap connections shall be made in separate side gutters as required with tap connectors. Suitable lugs or connectors shall be provided for connecting feeders. Tap connections to multiple lug feeders shall be made to all lugs at each tap joint.
13. Square D, Seimens and GE are acceptable manufacturers for panel-boards.

26 29 13 Enclosed Controllers

1. Motor starters (Individual), Magnetic Type:
    - Starter units for three phase motors shall be the combination full voltage type, consisting of a magnetic starter containing three manual reset thermal bimetallic overloads and low voltage protection. Each starter unit shall include a circuit breaker (MCP) disconnect for short circuit protection and provisions for locking switch, handle in the "on" and "off" positions. Each starter unit shall be complete with 2 extra normally open and 2 extra normally closed interlock contacts. Starters shall be mounted in NEMA 1 enclosure indoors and NEMA 4 outdoors. Minimum size shall be NEMA 1.
    - Units shall be equipped with individual 120 volt secondary control transformers as required with two primary and one secondary control fuse. The other secondary lead shall be grounded. Where indicating lights, solenoid valves and additional control components are energized from the control transformer, the capacity of the control transformer shall be proportionally increased.
    - Starter shall have "Hand-Off-Auto" selector switches and indicating red "run". Control units shall be of the heavy duty oil tight type. Lights shall be 120/6 volt type with lamp voltage rated 150% of normal voltage and of the miniature bayonet type only.
2. Manual motor starters for single phase motors shall be 2 pole, have a quick-break quick-make toggle mechanism that can be locked in "off" position, with a neon pilot light to indicate when motor is running, with thermal overload units as required. Enclosure shall be NEMA 1 for indoors, NEMA 4 for outdoors, or NEMA 7-9 for hazardous areas.

26 24 19 Motor Control Centers

1. Motor control centers shall be NEMA Class 1, Type B wiring. The 480V motor control centers shall consist of independent vertical sections, free standing on 4" channel iron sills with sections bolted together to make up the center. The section shall be 90" overall height, including the mounting sills. The width of each section shall be 20" (except large starters or other special panels which may be 30" in width). Structure depth shall be 20" and designed to mount starters in the front only. A maximum of six starter units shall be stacked in one vertical section. Terminal blocks for wiring shall be mounted within each starter unit and shall be factory wired. Each section shall be dead front, and rear access shall not be necessary for connections. Removable rear plates shall, however, be employed on the rear of the structure. Pan type doors shall be used for all units and future spaces. Doors shall be

hinged to the structure with a concealed hinge and fastened with pressure type fasteners. The top of each section shall have removable plates for access to the horizontal feeder bus and for conduit entry. A minimum of 12 gauge steel shall be used throughout the structure, including all doors and plates. All painted steelwork shall be treated with a primer coat and a finish coat.

2. The top of each section shall contain horizontal feeder bus bars of tin plated aluminum or copper which shall run continuously through the center from section to section. Provisions shall be made for easy addition and connection to adjacent sections. The horizontal bus shall be sized as required by the load, but in no case less than 600 amperes. The horizontal bus shall be braced to withstand the maximum fault current available at that point. The bus supports shall be formed of high dielectric strength, low moisture absorbing, high impact material with ample creepage distance between bus bars. Each section shall contain 3 vertical bus bars running the full working height of the section and connected to the horizontal feeder bus bars. The vertical bus bars shall be braced to withstand the maximum fault current available at that point. The bus support shall be formed of high dielectric strength, low moisture absorbing, high impact material with ample creepage distance between bus bars. Vertical bus shall be sized as required by the load, but in no case less than 300 amps.

3. Each section shall have a top horizontal wiring trough in front of the main horizontal bus. This wiring trough shall be protected from the horizontal bus bars by means of a steel barrier plate. The wiring trough shall be equipped with cable supports and the structure shall have a cutout in the end for continuous cable runs through the motor control center. A vertical wiring trough shall run the full working height of each section and shall be equipped with cable tie clamps. This vertical wiring trough shall be designed so as to allow installation wiring to the units with the unit doors open, but with the units in place.

4. Motor starter units shall be of the combination type with motor circuit protectors coordinated with motor overload relays. The interrupting rating assigned to the complete combination motor starters shall exceed the system short circuit capacity at the starter terminals. Starter units shall meet the requirements specified above.

5. A magnetic trip only molded case circuit breaker which serve as a main disconnect shall be provided where required. A horizontal copper ground bus 1/4" x 1" shall be provided with lugs for termination of the feeder and branch circuit ground conductors. Motor starter units shall connect to the vertical bus bar in each section with stab-on connectors shall be free-flowing silver plated clips, self-aligning and backed up with steel springs. Units shall be capable of being withdrawn from the structure with a minimum of difficulty. Unit support brackets shall be provided in the structure to properly align the units. Cam latch fasteners shall be employed on each unit to latch the unit in one of two positions in the structure.

    - The engaged position - Stabbed on the vertical bus.
    - The test position - With units withdrawn from the vertical bus, but still supported by the structure. In the test position, the pull-apart terminal block must still be capable of being engaged for electrical testing purposes.

6. In either engaged or test positions, the cam latching mechanism on the unit must be capable of being padlocked to prevent unauthorized movement of the unit. Units shall have complete steel top and bottom plates to provide maximum isolation between units. Units shall be of modular dimensions so that it is possible to readily interchange units of the same size without modifications in the structure.

7. Motor disconnect switch operating handles shall be interlocked with the door so that the door cannot be opened with the switch in the "on" position, except through a hidden release mechanism. The operating handle shall be arranged for padlocking in the "off" position with up to three padlocks. Motor starters shall be built, tested, and sized in accordance with NEMA Standards for Industrial Control, except that no smaller than NEMA Size 1 starters shall be employed in any unit. Motor overload protection shall be effected by three element overload relays with adjustable heater element positions.

8. Engraved nameplates shall be provided for each unit of the motor control center as well as the assembly. Screw or pin attachment only, no label tape for switchgear.

9. Motor Disconnect Switch: Provide a motor disconnect switch for any motor located from its starter unit. Switch shall be horsepower rated, heavy duty type, switch blades fully visible in off position when door is open, quick-made and quick-break mechanism, handle positions shall indicate and be lockable in "on" and "off" positions. Enclosures shall be NEMA 1 indoors, and NEMA 4 outdoors.
10. Provide a motor disconnect switch within sight of motor.
11. Yaskowa, ABB, and Trane TR 200 VFDs are acceptable manufactures. Same brand throughout project.

26 27 26 Wiring Devices

1. All wiring devices shall be industrial heavy duty specification grade, rated a minimum 20A, 125V.
2. Local wall switches shall be heavy duty specification grade, toggle, quiet type, color as approved by the University, fully enclosed in composition cases, rated 20 amp. 120/277 volt AC; Hubbell #1221 Series, or approved equal.
3. Receptacles generally shall be duplex, specification grade, 2 pole, 3 wire grounding type conforming to latest NEMA standards for 20 amp, 125 volt with back and side wiring, ivory; Hubbell #5362, or approved equal.
4. Receptacles for use with specific equipment, special applications, etc. shall be suitable for the load to be served and of proper configuration for the mating plug.
5. Switches and receptacles for wet hazardous areas shall be an approved type for the environment served. Receptacles near water basin or sink shall be GFCI IAW the code.
6. Receptacles fed from emergency power upon failure of normal power shall have cover of steel with red baked enamel and word "EMERGENCY" marked in white letters on cover.
7. Ground fault interrupter type receptacles shall be duplex 120V. AC 20 amps as required, Class A.
8. Device plates, telephone outlet plates, and blank plates in finished areas shall be .04 gauge 302 stainless steel with brushed finish.
9. Surface mounted multi-outlet system:
    - Multi-outlet systems shall consist of surface mounted metal raceways for use with number and type of wiring devices as required. Systems shall be complete with all fittings, etc. and shall be equal to Wiremold 2000 and G-3000.
    - Systems requiring combination power and telephone/communication multi-outlet with divider shall be equal to Wiremold G-4000 and G-6000 as required.
10. Provide a 20 amp duplex outlet in the corridor near each floor landing of each stair. Provide at least one 20 amp duplex outlet in corridors and space such outlets at 75 feet on center in all corridors.
11. Emergency Power Off (EPO) switches shall be double action to prevent accidental activation. They shall also be labeled as to which panel and breakers are tripped when activated if panel is not located in same room as EPO.
12. Refer to Part 3.1.5.5.6 for wiring devices criteria.
13. Label all outlets with panel and circuit number. Match numbering at panel with directory at panel.

26 28 16 Enclosed Switches and Circuit Breakers:

1. Circuit breakers shall be of the molded case, bolted in type consisting of the number of poles and ampere ratings as required. Two and three pole breakers shall be of the common trip type. Handle extensions providing manual operation will not be accepted.

2. Circuit breakers shall be of the indicating type providing "on", "off" and "tripped" position of the operating handle. When the breaker is tripped the handle shall assume a position between "on" and "off" positions. Breakers shall be of the quick-make and quick-break type toggle mechanism with inverse time trip characteristics. Automatic release shall be secured by a bimetallic thermal element releasing the mechanism latch. In addition, a magnetic armature shall be provided to trip the breaker instantaneously for short circuit currents above the overload range.
3. Circuit breakers shall be rated for the voltage of the circuit on which they are used. Circuit breakers with 225 ampere or larger frame sizes shall have interchangeable trips.
4. Locking tabs shall be provided on all circuit breakers serving emergency lighting, fire alarm system, security systems and other emergency or critical equipment.
5. Interrupting capacity of breakers shall be suitable for the power system. Available short circuit currents shall be noted on single line diagram on all major system buses and on panel schedules.
6. Circuit breakers feeding 120 volt lighting circuits that are not controlled by local wall switches shall be approved type "SWD" circuit breakers.
7. Circuit breakers for Heat Trace systems shall be a GFCI.
8. Breakers 100 amp or greater shall be tested IAW the NETA-ATS standard.

26 32 13 Engine Generator Assemblies

1. The emergency system shall consist of a diesel packaged engine generator set.
2. The generator shall be tested with a portable load bank by the Contractor.
3. Generator shall meet the requirements of NEMA MG1 and NFPA 37.
4. Shall have in-skid fuel tank and be rated at 480V/877V-3 phase 4 wire.
5. Fuel storage shall have adequate capacity in order to provide 24 hour run time at full load of the generator.
6. Outdoor units shall be in sound attenuated enclosure. Indoor units must have acoustical treatments to meet the required project NC rating. Sound attenuation/acoustical and exhaust design must be approved by the University.
7. Shall be provided with a full maintenance service. All generators shall have a minimum 2 year parts and labor warranty.
8. Acceptable manufacturer’s are Onan/Cummins, Kohler, and Caterpillar.
9. For generator design criteria see Part 3.1.5.5.6

26 42 00 Cathodic Protection

Underground steel pipe systems shall be cathodically protected using Pikotec or approved equal.

26 50 00 Lighting

1. Refer to Part 3 of this manual for interior and exterior lighting design criteria.
2. Emergency light fixtures shall be provided with the emergency power.

3. Ballasts
    - Fluorescent ballasts shall be electronic type with following features:

1) High frequency solid state electronic
2) High power factor (90% or higher)
3) Class P thermally protected
4) Have a harmonic distortion of less than 15% and comply with all current ANSI standards
5) Super - quiet operating sound level of 2 dB above a 16 dB ambient
6) Meet FCC requirements governing electromagnetic and radio frequency interference
7) Comply with all applicable State & Federal ballast efficiency standards
8) Listed & Approved by U. L.
9) Designed for use with T5 OCTIC type (265 ma) rapid start lamps.

Ballast manufacturers to be Advance, Universal or EBT.

4. Lamps
   - Fluorescent lamps shall be T5 rapid start Sylvania Octron F032/835 for 4 ft. units, and Sylvania Octron Curvalume FB031/835 (for 1 5/8" leg spacing) or FBO32/835/6 (For 6" leg spacing) for 2' x 2' fixtures, CRI 80 (minimum) 3500K color temperature or equivalent by G. E. or Philips.
   - LED lighting is preferred.
   - Incandescent lamps are not preferred and require specific Univeristy approval for use. When required shall be rated 130 volt for 120 volt circuits.
   - Emergency exit signs shall be Hubbell LED exits, models LED-1EM RB or LED-2EM RB or approved equal with light emitting diodes as the light source.
5. Exterior Lighting:
   - Street and parking lot poles shall be per the details.
6. Lighting Control:
   - Contractor shall provide the initial lighting control setup.
   - If any software/cabling are required, provide the University a copy of the software and a set of said cables.

26 52 00 Emergency Lighting

Emergency lighting shall be provided as required by code; including toilet areas, outdoors at all egress doors, mechanical / main electrical room and in laboratory areas.