DIVISION 26—ELECTRICAL

FORMAT

1. Technical Specifications content and numbering system shall be based on the 2004 CSI MasterFormat.

BASIS OF DESIGN

1. BGSU Design standards shall not replace fully developed, project and market specific technical specification. Associate shall utilize the Standards as a minimum standard to guide the design and execution in the field. Exceptions to these standards are allowed provided they are approved by Design & Construction.
2. In instances where fewer than 3 manufacturers are indicated, the Associate shall insert “or approved equal” in the Products section of the technical specifications.
3. All submitted substitute products shall be brought to the attention of Design & Construction prior to approval.

COORDINATION

1. Consult with the University regarding temporary electric service for each individual project. The source should be identified and the voltage and phase specified.
2. All exterior light locations should be staked out by the contractor and approved by the University and/or Associate prior to installation.

GENERAL PROVISIONS

1. Codes and Standards
   a. All work shall conform to the latest edition of the National Electrical Code.
   b. Codes shall be used as minimum requirements, and where the Construction Standards call for an installation that exceeds and does not violate the code requirements, the Construction Standards shall be followed.
   c. All materials shall conform to the standards of the Underwriter's Laboratories in every case where such standards have been established for the particular type of material in question.
   d. The complete electrical installation shall comply with all the requirements of OSHA.
   e. All material and equipment shall be UL listed and bear the UL label where such listing and labeling exists.
2. Branch Circuit
   a. In general, all lighting branch circuits shall be separate from power and receptacle branch circuits.
3. Basic Materials and Methods
   a. All boxes, brackets, bolts, clamps, etc., shall be galvanized, electro-galvanized, metalized, or sheradized.

260513—MEDIUM –VOLTAGE (HIGH) VOLTAGE CONDUCTORS

1. General:
   a. High voltage cables shall meet or exceed the latest additions ICEA S-93-639/NEMA WC74 (up to 46 kV), ASTM B-8, ASTM B-231, AEIC CS-6 and UL

1072.
   b. Cables and assemblies shall be UL approved and listed.
   c. Cables shall be Type MV-90, single conductor shielded, insulated with 133% insulation for use on an ungrounded 15 kV system.
   d. Cables shall be rated 90°C for normal operation, 130°C for emergency overload operation and 250°C for short circuit conditions.
2. Conductor:
   a. Conductor shall be uncoated soft copper, Class B, stranded compressed concentric round or compact.
3. Conductor Stress Shield:
   a. The strand shield and insulation shields shall be extruded layers of semi-conducting material compatible with adjacent layers of thermosetting compound with a volume resistively not in excess of 10 OHM meters at 90° applied over the conductor.
   b. The shield shall be clean stripping from the conductor and inseparably bonded to the overlying insulation. The thickness of the extruded conductor shield shall be as follows:
   c. Conductor Shield Thickness:

Conductor Size AWG/kcmil	Minimum Point (Mils)	Minimum Average (Mils)
8 – 4/0	12	15
250 – 500	16	20
600 – 100	20	25

4. Insulation:
   a. Insulation shall be EPR (ethylene-propylene rubber), extruded in triple tandem with the strand shield and the insulation shield.
   b. The insulation shall be flexible thermosetting dielectric based on an ethylene propylene elastomer colored to contrast with black conducting shield. The ethylene content of the elastomer used in the insulation compound shall not exceed 72% by weight of ethylene nor shall the insulation compound contain any polyethylene, both features to limit the degree of susceptibility to treeing experienced by highly crystalline materials.
   c. The minimum average insulation thickness shall be not less than that specified in the following table. The minimum thickness at any cross-section of the insulation shall be not less than 90% of the specified minimum average thickness.

Rated Voltage Phase-to-Phase kV	Conductor Size	Minimum Average Insulation Thickness Mils	5-Minute AC Withstand kV	15-Minute DC Withstand kV
	AWG/kcmil	133%	133%	133%
5	8 to 1000	115	23	45

	Above 1000	140	23	45
Rated Voltage Phase-to-Phase kV	Conductor Size	Minimum Average Insulation Thickness Mils	5-Minute AC Withstand kV	15-Minute DC Withstand kV
	AWG/kcmil	133%	133%	133%
8	6 to 1000 Above 1000	140 175	28 28	55 55
15	2 to 1000 Above 1000	220 220	44 44	80 80
25 (1)	1 to 2000	345	64	120
28 (1)	1 to 2000	345	69	125
35 (1)	1/0 to 2000	420	84	155

Note: ICEA S-93-639/NEMA WC74 and UL 1072 do not recognize the 133% insulation level for voltages above 25 kV.

5. Insulation Shield:
   a. The insulation shield shall be an extruded semi-conducting material compatible with adjacent layers of compound with a volume resistively not in excess of 10 ohmmeters at 90°C when tested per AEIC No. CS-6, and shall be clean stripping. The thickness of the extruded shield shall be in accordance with the following:

Calculated Minimum Dia. Over Insulation Inches	Insulation Shield Thickness Minimum Point (Mils)	Insulation Shield Thickness Maximum Point (Mils)
0 – 1.000	24	70
1.001 – 1.500	32	70
1.501 – 2.000	40	85
2.001 & Over	40	100

   b. The outer surface of the insulation shield shall be continuously printed with contrasting colored ink - "Semi Conducting - Remove When Splicing or Terminating".
   c. Magnetic Drain Shield:
   d. The magnetic drain shield shall be copper tape, nominal 5 mil in thickness with a minimum 12 -1/2% overlap.
6. Jacket:
   a. The overall jacket shall be PVC polyvinylchloride. Jacket thickness shall be as shown in the following table.

Cable Core Diameter (Inches)	Jacket Thickness Minimum Average (Mils)
0 – 0.425	45
0.426 – 0.700	60
0.701 – 1.500	80
1.501 – 2.500	110

   b. The minimum jacket thickness at any point shall be not less than 80% of the specified minimum average thickness. The jacket shall be suitable for operation at a rated temperature of 90°C for single conductor cables.
   c. A permanent identifying legend indicating manufacturer, plant number, conductor size, CU or AL, voltage, 100% or 133% insulation and insulation thickness shall be repeated on the jacket at 2'-0" intervals.
7. Field Testing:
   a. Field test cables after installation, using ICEA specified direct-current hi-pot cable test voltages, record results and incorporate into the Operation Instructions Manual.
   b. The cable manufacturer shall furnish recommended D.C. high potential test voltage and corresponding leakage current for field testing after cable installation.
   c. The Electrical Engineer or his representative shall witness the manufacture of the cable for this project.
   d. With special approval by the University, Interlocked Armored Cable Assemblies are acceptable in situations that standard conduit/cable installations are impracticable for high voltage conductors.
8. High Voltage Terminations:
   a. All terminations shall be installed by a journeyman experienced in high voltage termination work.
   b. Cable terminations for the conductive shielding of the 15 kV conductors shall be made with factory-molded, preinsulated slip-on terminators with rain shields to provide greater tracking distance. Cable terminators shall be 3-M Series 5600 Quick Term II or PLM Adalet FSD. Cable termination lugs shall be long barrel, 2-hole compression type, with the termination end closed to prevent moisture entrance into the cable.

260519—LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

1. Minimum size wire for lighting and power feeders and branch circuits (20 Ampere) shall be No. 12 AWG copper.
   a. Minimum size wire for control circuits shall be No. 14 AWG copper. All wire shall be stranded.
2. All conductors for feeders No. 2AWG and larger shall be Type XHHW copper, 600 Volt, unless otherwise noted on the Drawings.
   a. Conductors shall be insulated with virgin cross-linked polyethylene insulation.

b. All conductors smaller than No. 2AWG shall be Type THHN/THWN copper (per N.E.C.), 600 Volt.
c. Conductors shall be insulated with virgin PVC compound and shall have an overall extruded nylon jacket.
d. Nylon "skim" or "dip" coating IS not acceptable.

3. A green ground wire, sized according to the NEC Table 250-122, shall be installed in each conduit and kept isolated from the white neutral wire.
4. All wire and/or cable shall be delivered to the job site in full factory lengths of 500'-0" minimum. Longer reels may be used where conditions dictate.
5. Factory “shorts”, scrap or warehouse and prior job “clean-outs” (leftovers) will not be acceptable.
6. Feeder phase identification from left to right or front to back facing front of equipment shall be one of the following:

X	Y	Z	N
Black	Red	Blue	White (120/208 Volt Feeders)
Yellow	Brown	Orange	Gray (277/480 Volt Feeders)

7. Wire Connections and Devices:
   a. Taps and splices in all feeder and branch circuit conductors larger than No. 8 shall be made with approved solderless, pressure type bolted connectors.
   b. Splices in conductors No. 8 and smaller may be made with preinsulated Scotchlock or Ideal wing-nut spring tension connectors.
   c. Junctions made in exterior circuits shall utilize setscrew junction connector with three attachment points and a removable gel-filled cap and clamp; Raychem Gelcap SL.

260526—GROUNDING & BONDING

1. Flexible connections to motors shall be jumpered with a No. 14 green equipment grounding conductor, or per National Electrical Code Table 250-122.
2. Install a green bonding jumper between the outlet box and the receptacle grounding terminal on all flush mounted receptacles.
3. An insulated ground wire shall be installed in all feeder, branch circuit and lighting circuit raceways. Ground wire shall be sized in accordance with N.E.C. Article 250.
4. Grounding bushings shall be utilized on each conduit which is not bonded to a grounded enclosure by means of properly installed conduit nuts, one on each side of the enclosure panel and properly tightened such as to cut through the panel paint and make bare metal to metal contact.
5. Ground all step down transformers in accordance with N.E.C. Article 250-30 for Grounding Separately Derived Alternating Current Systems.
   a. The bonding jumper shall be directly connected to a grounding electrode.
   b. Transformer case shall be bonded to the grounding electrode conductor, but shall not be used as the grounding electrode.

   c. Grounding electrode conductor shall be protected within rigid metallic conduit.
6. Install grounding bonding jumper across all building expansion joints, conduit bussway and cable tray expansion fittings.
7. Install a building grounding electrode system in accordance with N.E.C. Article 250 and as required by the local inspecting authority.
   a. The building framework, metal siding, underground metal water piping, natural gas piping, concrete encased electrode and other made electrodes shall be sufficiently bonded together to form the grounding electrode system.
   b. Connections to the metal underground water piping system shall be made on the line side of the water meter.
   c. Natural gas piping shall not be utilized as a grounding conductor. It shall be the Contractor's responsibility to provide a grounding system acceptable to the local inspecting authority.
8. The Contractor shall demonstrate by testing that the electrical service grounding system to earth resistance value is 10 Ohms or less, utilizing a "clamp-on" or 3 point fall of potential tester.

260533—RACEWAY AND BOXES

1. Minimum conduit size shall be 3/4 inch.
2. Provide three (3) spare 1-inch conduits up and one (1) down, to ceiling spaces above and below from each new flush panel.
3. All rigid conduit and electrical metallic tubing shall be hot-dipped galvanized, sheradized, metalized, or electro-galvanized. No aluminum conduit will be permitted.
4. Conduit in stud partitions, concealed above ceiling, or above the bottom chord of bar joists may be electrical metallic tubing.
5. Conduit for circuits 100V to ground or greater in mechanical equipment rooms, electrical equipment rooms, chases, and areas subject to physical abuse shall be exposed rigid galvanized steel or intermediate grade conduit unless otherwise noted.
6. Conduit for circuits below 100V to ground in mechanical equipment rooms, chases, and areas subject to physical abuse shall be electrical metallic tubing.
7. Conduit in tunnels, exterior block walls, or exposed exterior shall be full weight rigid galvanized steel.
8. Buried Conduit:
   a. Exterior conduit below grade shall be minimum 1".
   b. Conduit buried in concrete pours shall be full weight rigid galvanized steel, Schedule 40 PVC, Schedule 80 PVC, or electrical non-metallic tubing.
   c. Conduit buried beneath building slabs shall be full weight rigid galvanized steel or Carlon Schedule 40 or Schedule 80 PVC.
   d. Exterior conduit below grade shall be full weight rigid galvanized steel or Carlon Schedule 40 or Schedule 80 PVC.
   e. Conduit exiting building perimeter through footings or grade beams shall be full weight rigid galvanized steel for 10'-0" on either side of penetration and shall be protected with a minimum of 3" Styrofoam top and bottom at exit point.
9. Feeders for 5 kV and 15 kV systems installed below grade shall be encased in

concrete.
10. Flexible galvanized steel conduit shall be used for "make-up" connections to rotating machinery (maximum 24"), equipment or flush lighting fixtures. Flexible conduit in damp or wet locations shall be liquid tight. Flexible conduit at exhaust fans shall allow hinged access into the exhaust fan.
11. Conduit installed in steam tunnels shall be anchored with "Hilti" type anchors. Plastic anchors shall not be used.
12. Conduits installed surface mounted shall utilize one-hole or two-hole type straps.
13. Pull and Junction Boxes:
    a. All pull boxes shall be galvanized sheet steel, minimum No. 14 gauge.
    b. Pull boxes shall not be installed in inaccessible locations.

260539—UNDERFLOOR RACEWAYS

1. Under floor cell duct shall be used only in large open areas where power, data/communication and/or Audio/Visual outlets are impractical.
2. All elbows and stub ups in firewalls shall be rigid galvanized steel. Elsewhere, elbows and stub ups not exceeding 24" above grade may be Carlon Schedule 40 or Schedule 80 PVC. All joints and terminations for PVC shall be made according to manufacturer's recommendations using "Carlon Solvent Weld Cement" to insure all joints are watertight.
3. All outlets shall be mounted in recessed activation kits with flush doors and wire management blocks.
4. Flush outlets or “monuments” shall not be utilized.
5. Floor Boxes:
    a. When floor boxes are necessary, utilize only types with outlets mounted in boxes with flush doors and wire management blocks.
    b. Flush floor outlets or "monuments" are not acceptable.

260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

1. Nameplates should be provided on all major equipment, including the following:
    a. Primary Switches
    b. Circuit Breakers & Switches in Distribution Panels
    c. Disconnect Switches
    d. Panels
    e. Motor Starters
    f. Motor Controls
    g. Transformers
    h. Contactors
2. Nameplates shall be plastic laminate, white face with black engraved letters, numbers, etc.
3. Warning/Sense tape with metal backing shall be installed 12” above exterior below grade feeders.

261200—MEDIUM-VOLTAGE PAD MOUNTED TRANSFORMER

1. Forthcoming

261300—MEDIUM VOLTAGE PAD MOUNTED SWITCHGEAR

1. G&W PVI series pad mounted combination unit, with two (2) SF-6 puffer main interrupters and up to four (4) breaker taps. Pad lockable, dead front-quick change bushings, front access painted Munsell green.
2. Typical PVI 62-376-12-62F switch unit; two (2) main interrupters rated 600A, 15.5 kV Class with four (4) vacuum breaker taps. Taps are SMU-20 fuse (type “E” breaker curve settings), 12,000A interrupting and 19,200A momentary. The following accessories are required; pressure gage, viewing windows, grounding lugs and approval of Bowling Green Municipal Utility Electrical Engineering Department.

262200—LOW-VOLTAGE TRANSFORMERS

1. Dry-type transformers are permitted to convert 480 volt emergency power to 120/208V-3PH-4W emergency power. Elsewhere, dry-type transformers shall not be utilized unless approved by the University.
2. Transformers 30 kVA through 112.5 kVA shall be 115ºC rise with 220ºC insulation. Transformers larger than 112.5 kVA shall be 80ºC rise.
3. Dry-type transformers shall be two winding, copper, indoor type arranged for floor or wall mounting.
4. High voltage rating shall be 480 volts with two 2-1/2% full capacity taps above normal and four 2-1/2% full capacity taps below normal voltage. Low voltage rating shall be 120/208 volts wye. Double lugs shall be provided on low voltage side at the transformer locations if required.
5. All transformers 30 kVA and larger shall be mounted on vibration mounts and be connected by using at least 6" of sealtite flexible conduit.

262413 - SWITCHBOARDS

1. Forthcoming

262416 - PANELBOARDS

1. The panels shall be not more than 92" high and shall be braced to withstand 200,000 amperes short circuit stress.
2. Neutral bus shall be isolated from the ground, except on the line side of the main switch.
3. Sections of distribution panels shall be bussed with full capacity, three-phase, four-wire copper bus.
4. Distribution panels may be circuit breaker or fusible switch type as made by Square D, Siemens, General Electric or Cutler-Hammer.
5. Bus bars shall be extended to the maximum standard height in each section. Equipment supplied with vertical bus sized to accommodate only the branch feeders supplied will be rejected.
6. Panels shall be designed with 20% spare capacity (physical and electrical capacity)
7. The associate shall include short circuit analysis on the construction documents.

262417 - BRANCH LIGHTING/RECEPTACLE PANELS

1. Panelboards shall be dead front type and equipped with thermal magnetic molded case circuit breaker units, as indicated.
2. Cabinets shall be galvanized, code gauge, sheet steel and shall be a minimum of 17" wide and 5-3/4" deep.
3. Provide adequate wiring and gutter space and a means for circuit identification. Provide a glazed, typewritten circuit directory.
4. Breakers shall be common trip, bolt type, rated a minimum of 10,000 amperes interrupting capacity. Breakers shall be rated for the load attached.
5. Panelboards shall be Square D, Siemens, General Electric or Cutler-Hammer.
6. Panelboards shall be designed for three-phase, four-wire service with copper bus.
7. Provide flush doors with lock and keys. Provide two (2) keys for each panel. All locks shall be keyed alike and match University Standard.
8. Panels shall be designed with 20% spare capacity.

262419—MOTOR-CONTROL CENTERS

1. Motors 1/3 HP and smaller shall be 120V or 208V, single-phase.
2. Motors 1/2 HP and larger shall be 208V or 480V, three-phase, depending upon voltage of building power.
3. Motors that are an integral part of packaged equipment may vary from the above to meet manufacturing standards.
4. Motor Starters:
   a. All motor starters and associated controls shall be provided with engraved laminated plastic nameplate.
   b. All single speed starters for motors smaller than 1/2 horsepower shall be manual starters complete with overload and pilot light.
   c. All starters and fusible combination magnetic starters for motors 1/2 horsepower and larger shall be magnetic motor starters. Starters shall be full voltage, non-reversing single-speed, NEMA 1 enclosed with overload heaters in each line. Starters shall be complete with 120 volt fused and grounded control transformer and heavy duty H-O-A selector switch mounted in the cover unless otherwise noted. A red pilot light, indicating motor running, shall be installed in the cover of each starter. Starters shall be as manufactured by Square D, General Electric, Siemens or Cutler-Hammer.
   d. Furnish the University three spare fuses of each type and rating of sizes installed upon completion of the project.
   e. Furnish a 16-gauge sheet metal enclosure with hinged cover of sufficient size to house the spare fuses.
5. Mount the enclosure near the main distribution panel.

262713—ELECTRICITY METERING

1. The building electrical system shall be monitored by a multi-function (V, A, kW, kVAR, PF, kWH) digital meter. The meter shall be networked into the campus system. The meter shall be EMON.

262726—WIRING DEVICES

1. Switches:
   a. Wall switches shall be 20A, industrial heavy duty Specification grade, nylon toggle, brass binding screws and shall be:
      i. Cooper 2221 Series
      ii. Hubbell HBL1221 Series
      iii. Leviton 1221 Series
      iv. Pass & Seymour PS20AC1 Series
   b. All wall switches shall be gray unless other colors are approved by the University on a specific project basis.
2. Receptacles:
   a. Duplex receptacles shall be industrial heavy duty specification grade 20A, side and back wired, solid brass mounting strap, fiberglass reinforced housing.
      i. Duplex receptacles shall be:
      ii. Cooper 5362 Series
      iii. Hubbell HBL5362 Series
      iv. Leviton 5362 Series
      v. Pass & Seymour 5362 Series
   b. Duplex receptacles connected to emergency power shall be red. All other duplex receptacles shall be gray unless other colors are approved by the University on a specific project basis.
3. Plates:
   a. Switch and receptacle plates shall be Type 302 stainless steel, Hubbell 97000 Series or approved equal by Cooper, Leviton or Pass and Seymour.
4. Installation:
   a. Feed thru wiring devices shall be pig-tailed.
   b. Wiring devices shall not be split wired.
   c. Circuit numbers shall be indicated on the inside face of the coverplate.

262813—FUSES

1. Low voltage fuses shall be as manufactured by Bussmann, Ferraz Shawmut or Littelfuse.
2. All fuses 0 to 600 amps shall be Type R rejection series.
3. All fuses shall be of the current limiting type as follows:
   a. 0 to 90 amps dual element, time delay Class RK-5; Bussmann FRN-FRS, Ferraz Shawmut TR-R TRS-R or Littelfuse FLN-R/FLS-R.
   b. 100 to 600 amps dual element, time delay, Class RK-1; Bussmann LPN-LPS, Ferraz Shawmut A2D-R A6D-R or Littelfuse LLN-RK/LLS-RK.
   c. Above 600 amps time delay, Class L; Bussmann KRP-C, Ferraz Shawmut A4BQ, 601 to 2000 amps, and A4BY above 2000 amps or Littelfuse KLP-C.

262818—DISCONNECTS

1. Motors located remote from the combination starters should have a disconnect in the power feeders, not a lockout stop in the control circuit.
2. Disconnects for exterior equipment and similar applications should be raintight, NEMA 3R.

3. All disconnect switches shall have interlock defeaters for maintenance purposes.
4. Disconnect switches shall be heavy duty type as manufactured by Square D, General Electric, Siemens or Cutler-Hammer.

263213—ENGINE GENERATORS

1. A natural gas engine driven electric generator with automatic transfer switch(es) shall be installed in all new buildings and in additions to existing buildings feeding emergency lights, EXIT lights, fire alarm system, basic telephone, and data communications.
2. The generator shall be provided with voltage, amp, frequency, and other necessary meters and all controls necessary for complete and reliable operation.
3. The generator will also have the necessary excitation control circuitry to prevent the lose of excitation on fault conditions allowing quick return to full voltage and power to normal and faulted circuits.
4. Remote generator annunciator with audible alert shall be located near fire alarm annunciator.
5. Emergency Lights:
   a. All emergency lights shall be provided and installed in accordance with the National Electric Codes and O.B.B.C. Provide at least one light connected to the emergency generation system in each mechanical room, electrical room, receiving room, and toilet room. Install a red dot (1/4” diameter) on the frame of emergency light fixtures.
6. Emergency Receptacles:
   a. Provide at least one duplex receptacle connected to the emergency generation system in mechanical and electrical rooms.
7. Heating and Cooling:
   a. Circulation pumps associated with chilled or hot water distribution shall be connected to emergency power. The HVAC system for the BDF Rooms shall be connected to emergency power.

263513—CAPACITORS

1. Capacitors shall be Myron Zucker Inc., Calvault VL with blown fuse indicating lights; or equal by Cornell-Dubilier, Cutler-Hammer, Sprauge, General Electric, or Square D.
2. Furnish and install banks of three-phase capacitors on all listed motors, 10 HP and larger. Motors with reduced voltage solid-state starters shall be provided with isolation contactor to connect the capacitor bank to the system with motor run signal.
3. Capacitors shall be located adjacent to motors where practical. An alternate location is above the motor control center. Capacitors shall be connected to the load side of the overload heaters. Overload heaters of motor starters shall be sized according to reduced current of motor nameplate amps due to addition of capacitors.
4. If motors are other than 1,800 RPM, the size shall be adjusted per RPM of the motor.
5. Capacitors shall not be installed on any central refrigeration unit, elevators or any variable speed motor.

6. Where motors are grouped reasonably close together, motor control centers should be used.
7. Reduced voltage starters shall be used for fans over 20 HP.
8. The minimum size combination starter shall be No. 1.

264113—LIGHTNING PROTECTION

1. When a lightning protection system is required, it shall be manufactured and installed in complete accordance with Underwriter's Laboratories Pamphlet No. UL96A Master Labeled "Lightning Protection Systems".
2. Upon completion, the Contractor shall furnish the University with the standard brass master label Type C plaque for installation within the structure.

264300—TRANSIENT-VOLTAGE SUPRESSION

1. Surge protection devices shall be provided on each main distribution, and sub-distribution. Surge protection devices shall be provided on branch panels that serve sensitive electronic loads (i.e. computers). Surge devices shall be external from the panels protected. The protection levels shall be:
   a. 200 kA (L-N, L-G, L-L, N-G) MDP
   b. 100 kA (L-N, L-G, L-L, N-G) SDP
   c. 60 kA (L-N, L-G, L-L, N-G) Branch Panel
2. The surge device shall be as manufactured by Current Technologies TG-Series or equal by Cutler-Hammer, General Electric, Liebert or Intermatic.

265000—LIGHTING

1. The wiring system for interior lighting shall utilize conduit and wire. Modular type systems shall not be permitted.
2. General illumination levels shall be as follows:
   a. Offices: 70 F.C.
   b. Classrooms: 55 F.C.
   c. Corridors, lobbies, stairs, toilets: 30 F.C.
   d. Store rooms, mechanical and electrical spaces: 20 F.C.
   e. Computer Laboratories: 50 F.C.
   f. Science Laboratories: 80 F.C.
3. Voltage for lighting fixtures shall not exceed 240 volts to ground unless approved by the University.

265100—INTERIOR LIGHTING FIXTURES

1. All general illumination fixtures shall be Specification grade fluorescent with “T8” lamps and electronic ballasts.
2. Fluorescent fixtures shall typically be 3-lamp, 2’x4’, recessed.
3. In most cases, use 18-cell semi-specular parabolic louvered.
4. In laboratories, kitchens, and other areas where cleanliness is critical for operation, specify acrylic lenses. See note #5 below.
5. In computer labs and similar spaces, specify fixtures that meet ANSI/HFS Standard No. 100-1988 for operator and VDT positions, such as Lithonia Optimax.

6. Electronic ballasts shall be Program Rapid Start Type, UL listed, "T8", 265 ma, high power factor, E.T.O. and C.B, M. approved, sound rated "A", Class "P".
   a. The ballast shall limit E.M.I. and R.F.I. emissions to within F.C.C. guidelines, and produce full light output and lamp life per lamp manufacturer's specifications.
   b. Total harmonic distortion shall be 10%or less, lamp current crest factor shall be less than 1.7, minimum power factor shall be .90 and the minimum ballast factor shall be .85.
   c. Electronic ballasts shall be manufactured by Advance, Universal/Magnetek or Osram Sylvania.
7. Fixtures with lenses shall have acrylic lenses with “A12” pattern and a minimum thickness of .125 inch. Shallow body (less than 4”D) fixtures with lenses shall have acrylic lenses with “A19” pattern and a minimum thickness of .156 inch.
8. All non-metallic louvers must meet state and local regulations regarding flame spread and smoke density generation.
9. Exposed fasteners shall be flush with adjacent surface with matching finish. Mounting hardware shall be concealed where feasible.
10. All fluorescent fixture housings shall be painted after fabrication with electrostatically applied baked white enamel with a minimum reflectance of 88%.
11. Straight tube fluorescent lamps shall be, "T8”, bi-pin, 3500K and CRI 80 with a low mercury content. Compact fluorescent lamps shall be 3500°K, CRI 80 with low mercury content. Incandescent lamps shall be 130V rated or have a life of 3000 hours (minimum). Energy savings equivalents shall be used when available. Lamps shall be General Electric, Osram Sylvania, or Philips.
12. Interior lighting fixtures shall be fluorescent, compact fluorescent, or metal halide. Incandescent lighting shall be utilized only under University approval.
13. Low-glare lighting (indirect or louvered) shall be provided in office areas, classrooms, and computer laboratories.
14. Classroom lighting switches shall be located near the marker board at the front of the room. A three-way switch shall be also located near the entry to the room. Four levels of lighting are required as follows:
   a. Full level for general use
   b. 1/3 / 2/3 (three lamp fixtures) or 1/2 / 1/2 (two lamp fixtures) for use of overhead projector
   c. Near dark for projection of other media
15. Dual-technology occupancy sensors shall be installed in all classroom spaces to over-ride “ON” switch positions when rooms are vacant.
16. Manual switch or four-hour timer withhold-on shall be used in all mechanical and electrical rooms. Manual spring return timers shall be used in other non-occupied, enclosed areas (1 hour).
17. Dimming controls or systems shall not be utilized unless otherwise approved by the University.

265300—EXIT LIGHTS

1. Exit lights shall be scratch resistant high impact thermoplastic with no visible knockouts, diffuse “LED” type. Exit lights in Residence Halls shall be wall mounted

and have a clear protective vandal-resistant shield.

265600—EXTERIOR LIGHTING

1. Exterior lighting shall be high pressure sodium. Exterior lighting shall be controlled via a master photocell. The photocell shall be “turn-lock” type, Tork 50015-2223 or equal. The photocell shall be mounted facing north on the roof or wall mounted on the building at 10’-0”.
2. Illumination levels shall be in accordance with I.E.S. recommendations.
3. Pedestrian walk poles shall be round straight aluminum, 14’-0” high x 5” diameter with dark bronze finish and cast aluminum base cover. Luminaries shall be dark bronze 150W high pressure sodium wide throw cutoff, KIM FM/WTH5/150 HPS 208/DB-P Series, no equals accepted.
4. Area lighting poles shall be round tapered steel with dark bronze finish and cast aluminum base cover. Luminaries shall be dark bronze 250W or 400W high pressure sodium cutoff, Lithonia KSF2-400S-R3-208 Series or equal by KIM.
5. Concrete pole bases shall be formed with a chamfered edge. Grinding of chamfer shall not be permitted. Concrete base shall be rubbed smooth. Finish coatings shall not be used.
6. Each leg of the feed to lighting poles shall be fused in the pole at the handhole. Fuse holder shall be in-line, non-breakaway, copper crimp terminal, weather-resistant, one conductor IN/OUT; Bussmann HEB Series.
7. Lighting contactors shall include hand-off-auto control mounted in the face of the contactor.
8. Exterior building mounted light fixtures below 15’-0” shall have full cut-off optics. Exterior building mounted light fixtures mounted above 15’-0” may be cut-off, adjustable flood, or wall-pack. Use of wall-pack or adjustable flood shall be approved by the University on a per incident basis.
9. Wall pack light fixtures shall have a die-cast housing, hydroform optics, borosilicate prismatic glass refractor, completely gasketed, and captive screw access; Holophane WL Series.

End of Section