

DIVISION 26 - ELECTRICAL

260000 - GENERAL PROVISIONS

1. All smoke detectors shall be located per manufacturer's specifications or a minimum of 40" or from the outside edge of any HVAC grille or diffuser, whichever distance is greater.
2. Elevators: Elevator floors shall be covered with ¼" (minimum) Luan board and walls of elevator shall be blanketed during construction in any building where the Elevator is to be used for any portion of the construction.
3. Fire Stopping: The E.C. shall be responsible for providing UL rated fire stopping at all penetrations of rated walls. It shall be the responsibility of the E.C. to verify with the owner where rated walls are located. Any non-rated penetrations shall be neatly sealed.
4. All fire stopping shall be labeled at point of penetration. Fire Penetration labels shall identify penetration location code, fire stopping material, and UL listing number. Coordinate any additional information required on the label with the University. Where fire stopping is located in unconcealed locations it shall be painted as directed by the University.
5. Prior to cutting or drilling any existing floor, the floor shall be X-rayed with ground penetration radar. Any existing power, plumbing, mechanical lines, etc. in x-rayed area shall be reported to the University's project manager.
6. Modifications to ANY panel circuits shall require a typed panel schedule update with the date modified and the company/individual performing the update.
7. All panels shall be identified with the panel name and "Fed From" nomenclature identifying where the panel is fed from. Coordinate with University prior to printing panel identification plates.
8. Circuit numbers with associated panel names shall be clearly indicated on the inside face of all the device coverplates (switches, receptacles, disconnects, etc.) as well as with a clear label on the front of each device (e.g. RP-2A Ckt 12). Labels shall match University Standards. Coordinate with project manager prior to installation.
9. All "T8" lamps shall be 28 Watt lamps where 4'-0" in length.

260001 - CODES AND STANDARDS

1. 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.
2. All work shall conform to the latest edition of the National Electrical Code.
3. 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.
4. The complete electrical installation shall comply with all the requirements of OSHA.
5. All material and equipment shall be UL listed and bear the UL label where such listing and labeling exists.
6. All work shall comply with all other applicable standards of The University of Toledo – Construction Design Standards.
7. This contractor shall coordinate with all other trades prior to rough-in/installation of any devices/equipment. All conflicts shall be brought to the attention of the University's project manager prior to proceeding with associated work.
8. NFPA Compliance:
 - a. NFPA 72 - National Fire Alarm Code
 - b. NFPA 72E - Automatic Fire Detectors
 - c. NFPA 101 - Life Safety Code
 - d. NFPA 70 - National Electrical Code
 - e. Local, State and National Codes, Local and State Fire Marshal Codes. It shall be the Contractor's responsibility to obtain approval from all reviewing agencies.
 - f. NPFA 1221 – Standards for the installation, maintenance, and use of emergency service communications systems.
 - g. NFPA 72 Annex E – Mass Notification Systems.
 - h. DOD – UFC 4-021-01, 2007 (Department of Defense)
 - i. Intelligibility of Fire Alarm & Emergency Communication Systems, dated November 2008. This document shall be complied with as though it were a published and accepted standard
 - j. Underwriters Laboratories, Inc. (UL)
 - 1) UL-864 - Control Units for Fire Protective Signaling Systems (9th Edition)
 - 2) UL-268 - Smoke Detector for Fire Protective Signaling Systems

- 3) UL-268A - Smoke Detectors for Duct Applications
 - 4) UL-521 - Heat Detectors for Fire Protective Signaling Systems
 - 5) UL-464 - Audible Signaling Appliances
 - 6) UL-1971 - Signaling Devices for the Hearing Impaired
 - 7) UL-38 - Manually Actuated Signaling Boxes
 - 8) UL-1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
 - 9) UL-1481 - Power Supplies for Fire Protective Signaling Systems
 - 10) UL-1638 - Signaling Appliances – Private Mode Emergency and General Utility Signaling
 - 11) UL 2572 - Control and Communication Units for Mass Notification Systems
 - 12) Note control equipment that is not dually UL 864 and 2572 listed are not acceptable.
9. All work in areas where patient care is administered shall conform with all parts of N.E.C. Article 517.

260002 – PERMITS

1. Unless noted otherwise in on bidding documents, the building permit will be acquired and paid for by the A/E. When there is no A/E for the project all permits and fees shall be obtained by the Electrical Contractor. The Electrical Contractor shall obtain and pay for all other permits/inspections required for his work.
2. The E.C. shall be responsible to obtain all Elevator permits. A permit is required for each Elevator. Coordinate with the A/E.
3. Fire Alarm permit costs shall be included in the Electrical Contractors price and obtained by the Engineer of Record.

260003 - TEMPORARY ELECTRICAL SERVICE

1. Consult with the University regarding temporary electric service for each individual project. The source should be identified and the voltage and phase specified.

260004 - GENERAL (Branch Circuits)

1. In general, all lighting branch circuits shall be separated from power and receptacle branch circuits.

260005 - LAYING OUT WORK

1. All exterior light locations should be staked out by the contractor and approved by the University and/or Associate prior to installation.

260006 - CONNECTIONS TO EXISTING EQUIPMENT

1. Connections to existing systems requiring outages shall be communicated to the University a minimum of two weeks prior to proposed outages and shall be during premium working hours as designated. All communication shall be to the University's Project Manager.

260100 - OPERATING AND MAINTENANCE MANUALS

1. When the building is substantially completed and before the building is taken over by the University of Toledo for maintenance purposes, the Contractor shall provide a complete operation and maintenance manual. The manual shall consist of an indexed loose-leaf binder containing the manufacturer's installation, part numbers, approved specification sheets of all equipment installed, operating, maintenance, repair parts manual for each system and component, and panel schedules for each panel modified or installed.

260101 - RECORD DRAWINGS

1. The Electrical Contractor will be required to furnish one complete set of "as built" prints.
2. The drawings should include the following information:
 - a. The location of all outlets, fixtures, junction boxes, etc., as installed.
 - b. Conduit runs in their relative location with conduit and wire size, and
 - c. The number of wires for each run. Identify whether conduit is in the floor, ceiling, or exposed.
 - d. Complete riser diagrams for power, light, fire alarm, sound, television, telephone, clock and any special systems.
 - e. Locations where low voltage cabling and conduits pass thru wall shall be accurately shown on "as built" drawings. It shall be the appropriate vendor's responsibility to incorporate these locations electronically on their shop drawings and turn over to the University.
3. Each floor should have separate drawings for light, power, and signal systems.

260102 – WARRANTY

1. This Contractor shall warranty all labor on equipment, and all wiring free from mechanical and electrical defects for a period of one year from the date of installation. All warranty labor service shall be included in this warranty, including work required during premium time (i.e., nights, weekends and holidays).

260500 - BASIC MATERIALS AND METHODS

1. All boxes, brackets, bolts, clamps, etc., shall be galvanized, electro-galvanized, metalized, or sheradized.

260519 - LOW VOLTAGE CONDUCTORS

1. Minimum size wire for lighting and power feeders and branch circuits (20 Ampere) shall be No. 12 AWG copper. 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. Conductors shall be insulated with virgin cross-linked polyethylene insulation. All conductors smaller than No. 2AWG shall be Type THHN/THWN copper (per N.E.C.), 600 Volt. The conductors shall be insulated with virgin PVC compound and shall have an overall extruded nylon jacket. Nylon "skim" or "dip" coating will not be 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:

<u>X</u>	<u>Y</u>	<u>Z</u>	<u>N</u>
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. Splices in conductors No. 8 and smaller may be made with preinsulated Scotchlock or Ideal wing-nut spring tension connectors.

8. 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.
9. The use of bridal rings is prohibited. Where cabling is not required to be in conduit as directed by the owner J-hooks may be used for low voltage cabling.
10. Each 120-Volt or 277-Volt branch circuits shall be installed with a dedicated neutral wire from the circuit source to the load connection, unless specifically indicated otherwise on the drawings.

260526 – GROUNDING

1. Ground all conduits, cabinets, meters, panels, fixtures and other exposed non-current carrying metal components of electrical equipment in accordance with all provisions of the National Electrical Code.
2. Flexible connections to motors shall be jumpered with a No. 14 green equipment grounding conductor, or per National Electrical Code Table 250-122.
3. Install a green bonding jumper between the outlet box and the receptacle grounding terminal on all flush mounted receptacles.
4. 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.
5. 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.
6. Ground all step down transformers in accordance with N.E.C. Article 250-30 for Grounding Separately Derived Alternating Current Systems. The bonding jumper shall be directly connected to a grounding electrode. The transformer case shall be bonded to the grounding electrode conductor, but shall not be used as the grounding electrode. The grounding electrode conductor shall be protected within rigid metallic conduit.

7. Install grounding bonding jumper across all building expansion joints, conduit busway and cable tray expansion fittings.
8. Install a building grounding electrode system in accordance with N.E.C. Article 250 and as required by the local inspecting authority. 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. Connections to the metal underground water piping system shall be made on the line side of the water meter. 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.
9. 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.
10. Provide additional grounding as required per N.E.C. Article 517.13 in all patient care areas of Clinical Buildings (as identified by the University). Buildings with patient care area include but are not limited to: University Medical Hospital, Ruppert Center, Dana Center, Dowling Hall, and Ruppert Center. Coordinate buildings/area designated as 'Clinical' with University project manager prior to installation.

260533 – CONDUIT

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, shreadized, 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. Conduit buried in concrete pours shall be full weight rigid galvanized steel or Schedule 40 PVC.
9. The Electrical Contractor shall obtain a 'Dig Permit' per the University's Construction Design Guidelines (Supplemental Instructions)
10. UL listed flexible metal raceways and metal sheathed cable assemblies may be used in length up to 6'-0" for luminaire connections.
11. Rigid galvanized steel conduit (shall not be required in electrical closets smaller than 400 square feet). In closets larger than 400 square feet rigid conduit shall be used up to 10' out of the top of any panel.
12. Conduit couplings may be steel compression or set screw fittings only.
13. 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.
14. 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.
15. Conduit installed in steam tunnels shall be anchored with "Hilti" type anchors. Plastic anchors shall not be used.
16. Conduits installed surface mounted shall utilize one-hole or two-hole type straps.
17. Exterior conduit below grade shall be 1" minimum.
18. Pull and Junction Boxes:
All pull boxes shall be galvanized sheet steel, minimum No. 14 gauge. Pull boxes shall not be installed in inaccessible locations.
19. Bridle rings may not be used. J-hooks are acceptable.

260539 - UNDERFLOOR DUCTS

1. Under floor cell duct shall be used only in large open areas where power, data/communication and/or Audio/Visual outlets are impractical. Under floor duct shall only be used with written approval from University project manager.
2. All outlets shall be mounted in recessed activation kits with flush doors and wire management blocks.
3. Monuments style floor boxes shall not be used.
4. Floor Boxes:
 - a. When floor boxes are necessary, utilize only types with outlets mounted in boxes with flush doors and wire management blocks.

260553 – IDENTIFICATION

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 should be plastic laminate, white face with black engraved letters, numbers, etc. All panels shall be identified with the panel name and “Fed From” nomenclature identifying from where the panel is fed. Identification plates shall also indicated equipment voltage. Coordinate with University prior to printing panel identification plates.
3. Warning/Sense tape with metal backing shall be installed 12” above exterior below grade feeders.

26 0574 Arc Flash Program

1. An Arch Flash study shall be performed on any new building or partial building renovation unless directed otherwise in writing by the University.
2. The Arc Flash Program shall be prepared by:

JDRM Engineering

5604 N. Main St. Suite 200
Sylvania, OH 43560
(419) 824-2400
www.jdrm.com

3. The preparation by the above Engineer shall include a Short Circuit Study, Protective Device Evaluation Study, Protective Device Coordination Study, Arc Flash Hazard Analysis, and Arc Flash Labels for the electrical distribution system as shown and/or described on the one-line drawings including their loads. The cost for the study noted above shall be included in the Electrical Contractor's bid price. The Electrical Contractor shall provide JDRM Engineering documents required to quote project in question, obtain a fee, and include it in their bid.
4. The Contractor shall survey the facility electrical power distribution system for the purposes of recording and documenting all data required to complete engineering studies and one-line diagrams. The E.C. shall utilize data collections sheets as provided by the Engineer. Information provided by other means is not acceptable. No information should be collected until a meeting with JDRM Engineering has been completed to insure information is collected in accordance with the University standards.
5. The E.C. shall include in his price the cost to install the labels. Label locations shall be coordinated with the Engineer and the University prior to application.

262200 - DRY-TYPE TRANSFORMERS

1. Dry-type transformers are permitted to convert 480 volt power to 120/208V-3PH-4W power. Elsewhere, dry-type transformers shall not be utilized unless approved by the University.
2. Transformers 30 kVA through 112.5 kVA shall be 115°C rise with 220°C insulation. Transformers larger than 112.5 kVA shall be 80°C 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.

6. All dry type transformers shall be Harmonic Mitigating Isolation Transformers unless approved in writing the University Project Manager. This Harmonic Filtering Transformer must meet the following requirements:
 - a. Provide a medium zero-sequence impedance path for all zero-sequence currents, including all zero-sequence harmonic currents (i.e. I_3 , I_9 , I_{15} , I_{21} , --) in its secondary three-phase, four-wire subsystem.
 - b. Provide a primary-secondary phase-shift of 0^0 in order to achieve cancellation of 5^{th} , 7^{th} , 17^{th} , 19^{th} -- positive- and negative-sequence harmonic currents on the units' primary bus, equal to the lesser source of each individual harmonic current through each model, thereby treating all of the foregoing harmonic currents.
 - c. Reduce voltage and current distortion on the primary side of the unit, and voltage distortion on the secondary side of the unit.
 - e. Reduce voltage/current imbalance on the primary side of the unit.
 - f. Reduce current crest factor thereby reducing the de-rating requirement of the primary system components.
 - g. Reduce load K-factor at the transformer which supplies the unit.
 - h. Reduce average/peak phase current on the primary side of the unit.
 - i. Harmonic cancellation shall be by electromagnetic means only. No capacitors or electronics shall be used.
 - j. Improve power factor.
 - k. Design shall be optimized for harmonic rich and high neutral current environment.

262416 - DISTRIBUTION PANELS

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 Eaton.
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 physical and electrical capacity.

7. All panels shall be provided with Arc Flash Labels as required by the National Electrical Code.
8. Yellow paint shall be neatly be provided on the floor in unfinished spaces only to show the clearance to be maintained in front of each panel. In the front of panels 208V equipment shall maintain a clearance of 36", 480V equipment shall maintain a clearance of 48". The width of the space shall be 30" or the width of panel, whichever is greater. Consult the campus Electrical Supervisor or project engineer prior to painting any floors.
9. All floor mounted switchgear shall be mounted on a 4" concrete curb.

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.
10. Panels shall be designed with 30% spare space capacity and electrical.
11. All panels shall be provided with Arc Flash Labels as required by the National Electrical Code.
12. Each 120-Volt or 277-Volt branch circuits shall be installed with a dedicated neutral wire from the circuit source to the load connection, unless specifically indicated otherwise on the drawings. Handle ties are not acceptable.

13. Yellow paint shall be neatly provided on the floor in unfinished spaces only to show the clearance to be maintained in front of each panel. In the front of panels 208V equipment shall maintain a clearance of 36", 480V equipment shall maintain a clearance of 48". The width of the space shall be 30" or the width of panel, whichever is greater. Consult the campus Electrical Supervisor or project engineer prior to painting any floors.

262419 – MOTORS

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.
 - f. Mount the enclosure near the main distribution panel.

262713 – METERS

1. All metering shall be provided at MDP or as specified by the University of Toledo. All metering shall be GE PQM II Power quality meter with Multinet FE Protocol Converter. Meters to include all shorting blocks and fuse

blocks as needed. The meter shall be networked into the campus system. Coordinate with the Electrical Systems Manager prior to pricing/purchasing any meters. **Include network connection back to applicable building data closet.**

262726 - WIRING DEVICES

1. Switches:
 - a. Wall switches shall be 20A, industrial heavy duty Specification grade, nylon toggle, brass binding screws and shall be:
 - 1) Cooper 2221 Series
 - 2) Hubbell HBL1221 Series
 - 3) Leviton 1221 Series
 - 4) 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.
 - b. Duplex receptacles shall be:
 - 1) Cooper 5362 Series
 - 2) Hubbell HBL5362 Series
 - 3) Leviton 5362 Series
 - 4) Pass & Seymour 5362 Series
 - c. 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.
 - d. Duplex receptacles in Clinical Buildings (as identified by the University) shall be Hospital Grade in all patient care areas as specified in NEC Article 517. Coordinate buildings/area designated as 'Clinical' with University project manager prior to installation.
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 - OVERCURRENT PROTECTIVE DEVICES

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.

264300 - TRANSIENT VOLTAGE SURGE PROTECTION

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.
 - g. Exam Rooms: 60 F.C.
 - h. All other lighting shall conform with current IESNA recommendations.
3. Voltage for lighting fixtures shall not exceed 240 volts to ground unless approved by the University.
4. All new lighting and associated controls shall conform to the current state adopted version of AHSRAE 90.1.
5. Where feasible, provide a connection between VAV boxes and the lighting control system for 'step-back' during unoccupied periods in areas with automatic lighting control. Indicated cabling shall be provided an occupied/unoccupied signal from the lighting control to the VAV boxes. Coordinate associated programming and wiring with the VAV box supplier prior to installation.

265100 - INTERIOR LIGHTING FIXTURES

1. All general illumination fixtures shall be Specification grade fluorescent with "T8" or "T5" lamps and electronic ballasts. "T8" lamps shall be 28 Watt lamps where 4'-0" in length.
2. Electronic ballasts shall be Program Rapid Start Type, UL listed, "T8" or "T5", 265 ma, high power factor, E.T.O. and C.B, M. approved, sound rated "A", Class "P". 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. 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. Electronic ballasts shall be manufactured by Advance, Universal/Magnetek or Osram Sylvania.
3. 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.

4. All non-metallic louvers must meet state and local regulations regarding flame spread and smoke density generation.
5. Exposed fasteners shall be flush with adjacent surface with matching finish. Mounting hardware shall be concealed where feasible.
6. All fluorescent fixture housings shall be painted after fabrication with electrostatically applied baked white enamel with a minimum reflectance of 88%.
7. Straight tube fluorescent lamps shall be, "T8" or "T5", bi-pin, 3500K (Health Science Campus), 4100K (Main Campus) and CRI 80 with a low mercury content. Compact fluorescent lamps shall be 3500°K, CRI 80 with low mercury content. Lamps shall be General Electric, Osram Sylvania, or Philips.
8. Interior lighting fixtures shall be fluorescent, compact fluorescent, or LED. Incandescent, metal halide, or high pressure sodium lighting shall be utilized only under University approval.
9. Low-glare lighting (indirect or louvered) shall be provided in office areas, classrooms, and computer laboratories.
10. 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
11. Dual-technology occupancy sensors shall be installed in all classroom spaces to override "ON" switch positions when rooms are vacant.
12. 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).
13. Incandescent fixtures may only be used with prior approval from University's Electrical Systems Manager.

265300 - EXIT LIGHTS

1. Exit lights shall be Edge-lit style, red letters. Lithonia EDG series.
2. Exit lights shall be wired to life-safety/generator circuits where a generator serves a building.

265600 - EXTERIOR LIGHTING

1. All Exterior lighting shall be LED style as manufactured by Beta ARE-EDG series. Coordinate exact fixture and number of light bars with Innovative Lighting Systems. Exterior lighting shall be controlled via a time clock.
2. Illumination levels shall be in accordance with I.E.S. recommendations.
3. Pedestrian walk poles shall be round straight aluminum, 10'-0" or 14'-0" high x 5" diameter with spun aluminum finish and cast aluminum base cover. Luminaries shall be Beta ARE-EDR-R5 (3 bars) - No equals accepted. Coordinate exact fixture and number of light bars with Innovative Lighting Systems.
4. Area lighting poles shall be round tapered finish and cast aluminum base cover. Luminaries shall be dark bronze LED type. Fixture shall be as follows: Beta ARE-EDG-R3 .Coordinate exact fixture and number of light bars with Innovative Lighting Systems.
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 set screw terminal, weather-resistant, one conductor IN/OUT.
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. Fixture shall be Beta SEC-EDG-WM series. Coordinate exact fixture and number of light bars with Innovative Lighting Systems.

274000 - AUDIO-VISUAL REQUIREMENTS

1. Consult with the University Media Services Department for specific project program requirements.

283000 - FIRE ALARM

1. Provide all buildings with an electrically operated, supervised, closed circuit, and addressable voice fire alarm system. The equipment shall include master control panel, break stations, combination speakers and strobes (both clear and amber strobes), annunciators, smoke detectors, door holders, etc.
2. In all locations where a fire alarm strobe is needed by code an amber strobe must be installed adjacent to or as part of the same device.
3. Fire Alarm system equipment on the Main Campus must be by Simplex-Grinnell. Fire Alarm system equipment and programming for the Main Campus must be provided by:

Simplex-Grinnell Building Systems Sales
3661 Briarfield Blvd., Suite 101
Maumee, OH 43537
419-861-0662
chrobbins@simplexgrinnell.com

Fire Alarm system equipment on the Health Science Campus must be by Edwards Systems Technology. Fire Alarm system equipment and programming for the Health Science Campus must be provided by:

Asset Protection Corporation
5211 Renwyck Dr.
Toledo, Oh 43615
419-531-3400
www.apcamerica.com

4. The equipment shall be manufactured by Simplex Time Recorder Co. or Edwards Systems Technology as applicable by campus unless written approval of another manufacturer is provided by the University.
5. The system shall include integration of automatic tornado warning. Tornado signals and fire alarm signals shall have distinct tone differences. Provide the tone for each signal as directed by the University. The tornado warning system shall consist of a VAR Receiver interfaced to the alarm system such that, when activated, the following shall occur:
 - a. The tornado warning tone within the fire alarm system shall be activated to cause the tornado signal to sound throughout the entire

- building.
 - b. The signals may be reset by operating the signal silence button on the alarm panel.
6. In Residence Halls, room smoke detectors, when activated, shall sound their local alarm only and annunciate at the control panel and annunciators. If not reset within an adjustable time period building alarm devices will sound.
 7. Fire alarm signals shall be provided with semi-flush mounted signal and lamp unit with red trim and red lenses imprinted with the word "FIRE".
 8. Fire alarm signals shall be twenty-four (24) VDC speakers and strobes designed for mounting in signal lamp unit.
 9. Ceiling smoke detectors shall be addressable photoelectric type. In Residence Halls, room detectors shall include a local 90 dB sounder.
 10. Duct ionization smoke detectors shall be furnished with sampling tubes and sensor. Detectors shall also contain a panel programmable relay to control fan shutdown upon this device activation or upon activation of any other device in system.
 11. The remote annunciator shall be serial LCD type with 80 character display. The annunciator shall duplicate the signals occurring at the main control panel. Also provided shall be:
 - a. Control Pushbutton Switches For: Alarm silence, trouble silence, system reset and manual evacuation duplicating the control panel switches. A key "enable" switch shall be provided to activate or deactivate the control switches.
 - b. Tone Alert: Duplicates the control panel piezo during alarm and trouble conditions.
 - c. System Trouble LED.
 - d. Power on LED.
 11. All new Annunciators or Fire Alarm Control Panels installed on the Health Science Campus shall be integrated into the existing campus fiber loop (12 fiber – single mode). Fiber shall be included in the Electrical Contractors bid and shall be Corning 012E8P-311XX-A3-RED. Coordinate new locations with JDRM Engineering (See 26 0574) and University Project Manager prior to installation
 13. All wiring shall be in conduit. Color code shall be used and all wires shall be tagged at all junction points and shall test free from ground or crosses between conductors.

14. The completed fire alarm system shall be designed to NFPA-72 standards and fully tested in accordance with NFPA-72H by the Contractor in the presence of the Associate, the University's representative and the local Fire Marshal. Upon completion of a successful test, the Contractor shall so certify in writing to the University.
15. Permits shall be the responsibility of the Electrical Contractor.
16. Fire alarm systems "as-built" AutoCAD drawings must be turned over to JDRM Engineering as part of the closeout process.
17. All smoke detectors shall be located per manufacturer's specifications or a minimum of 36" or from the outside edge of any HVAC grille or diffuser, whichever distance is greater.
18. All new Annunciators or Fire Alarm Control Panels installed on the Health Science Campus shall be integrated into the existing campus fiber loop (12 fiber – single mode). Fiber shall be included in the Electrical Contractors bid and shall be Corning 012E8P-311XX-A3-RED. Coordinate new locations with JDRM Engineering (See 26 0574) and University Project Manager prior to installation
19. All fire alarm system cable 16 AWG and larger shall be stranded cable.
20. Ceiling mounted fire alarm devices shall be supported by the following adjustable T-bar spreader: B-Line BA50A. No substitutes may be provided. If another type is used the E.C. will remove and replace with this model. Use of another style may only occur with written prior approval by University Facilities Manager. Shop drawings are not an acceptable method of this approval.

END OF DOCUMENT