LUFACILITIES

MEP Guidelines

Revised: February 15, 2022

TABLE OF CONTENTS

PAGE

PURPOSE AND CHARGE TO LEHIGH UNIVERSITY CONSULTING FIRMS

These Design Guidelines shall be incorporated into all projects, by the engineering consulting firm, from inception through construction documentation without exception. Any deviation from this charge shall require the review and authorization by the Lehigh University Facilities Services, Campus Planning, and Projects team assigned to the project. It is required that all consulting engineering firms use these Design Guidelines as a quality control instrument, to assure that all design and construction documents have captured Lehigh University's desired intent for a successful outcome. The Design Guidelines are not intended to be a complete and exhaustive list of all of the components required for the successful design and construction documentation of a project. The intent is to provide a consistent and reliable level of expectations for design, detailing, quality, and cost control for improved project delivery with the absence of omissions and consequential added cost (change orders).

CONSULTING FIRM ACCEPTANCE OF LU DESIGN GUIDELINES, PURPOSE AND CHARGE

_____

Consulting Firm Name *January 21, 2021 = LU Design Guideline Issue Date*

_____ _____ _____

Consulting Firm Principal *Signature* *Date*

MATERIAL GUIDELINES

DIVISION 1 – GENERAL CONDITIONS

Reserved

DIVISION 2 – EXISTING CONDITIONS

Survey:
All consulting engineering firms are required to perform a survey of the existing spaces to be renovated. All existing MEP/FP systems shall be surveyed by removing the existing acoustical ceiling tiles (where applicable) to the extent required/permitted to capture the required survey information to confirm/document the existing system design and physical constraints of the existing structure. While reasonable accurate files may exist for many areas of Lehigh University facilities, they are not guaranteed to be accurate or current. Therefore, the consulting firms are required to determine the level of survey necessary to successfully execute the design and construction. Off/after hour access can be arranged by Lehigh University Facilities Services, Campus Planning, and Projects Department if required to complete the survey.

DIVISION 21 – FIRE SUPPRESSION

Sprinklers:
Design of sprinkler systems to comply with all applicable codes including NFPA 13 and FM Global Standards. When applicable, designs must be reviewed and approved by The Travelers Companies, Inc. (Lehigh University Insurance Carrier). Fire protection contractor must provide signed and sealed submittal drawings including hydraulic calculations for review and approval.

Concealed Sprinkler Heads (Lehigh University preferred standard): FM Global has approved Viking Mirage Standard and Quick Response Concealed Pendant Sprinkler VK462 and HP Sprinkler VK463 designed for installation of concealed pipe systems where the appearance of a smooth ceiling is desired.

Do not locate sprinkler heads close to a heat source that may cause inadvertent discharge.

In a non-heated area, glycol is not to be used as an alternative to a dry sprinkler system. When a dry sprinkler system is required it shall be a *Victaulic* Series 768 FireLock NXT.

Refer to Life Safety section on the Facilities website for the complete life safety sprinkler system standard.

WET PIPE SPRINKLER SYSTEMS – SECTION 211313

DRY PIPE AND PREACTION SPRINKLER SYSTEM – SECTION 211316

DIVISION 22 – PLUMBING

Demolition:
Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed. Remove portions of piping to be removed and cap or plug remaining piping with same or compatible piping material. Do not abandoned any piping or materials in place unless specifically approved by Lehigh University. Where piping is to be abandoned, drain piping and cap or plug piping with same or compatible piping material. Disconnect and cap services for equipment to be removed. Equipment to be removed and reinstalled shall be removed, cleaned, and stored; when appropriate, reinstall, reconnect, and make equipment operational.

Pipe Penetrations:
Install escutcheons for penetrations of walls, ceilings, and floors. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals. Install steel pipe for sleeves smaller than 6 inches in diameter and cast-iron "wall pipes" for sleeves 6 inches and larger in diameter. Select type and number of sealing elements required for pipe material and size for Mechanical Sleeve installation. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals. For mechanical sleeve seal Installation, select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space

between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

Pipe Hanger Insulation:
Attach clamps and spacers to piping. Clamp for piping operating above ambient air temperature may project through insulation. Use thermal hanger for piping operating below ambient air temperature. Use thermal-hanger shield insert with clamp sized to match outside diameter of insert. Install protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation. Install protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

Identification for Piping and Equipment:
All piping shall have adhesively applied labels identifying the system service and using arrows indicating direction of flow. Lettering size shall be at least 1 ½" high. Labels shall be spaced at intervals of 25 feet.

Equipment labels shall be black plastic type with white lettering, with pre-drilled holes for attachment hardware. Minimum letter size shall be ¼".

Plumbing Insulation:
Domestic hot and recirculated hot water piping shall be insulated with 1" thick mineral-fiber, preformed pipe insulation.

Domestic cold-water piping shall be insulated with 1" thick mineral-fiber preformed pipe insulation.

Exposed sanitary drains, domestic cold water, domestic hot water, and stops for plumbing fixtures for people with disabilities shall be covered with 1" thick mineral-fiber, preformed pipe insulation and PVC jacket.

Rainwater piping (primary and secondary) shall be insulated with 1" thick mineral-fiber, preformed pipe insulation.

Roof drain and overflow drain bodies shall be insulated with 1" thick mineral-fiber, preformed pipe insulation.

Provide PVC jacket on all exposed piping within 10'-0" of finished floor.

General-Duty Valves for Plumbing piping:
All brass or bronze ball valves shall be two-piece full-port type with brass trim.

Expansion Fittings and Loops for Plumbing Piping:
Flexible, copper braided hose, expansion loops shall be used for copper domestic hot water piping systems. Expansion loops shall be limited to Metraflex Inc., Flex-Hose Co. Inc. or Flexicraft Industries.

Meters and Gauges for Plumbing Piping:
All water meters shall be electromagnetic, Onicon Series 3200. Meters must communicate via Modbus to direct digital control (DDC) via Ethernet connection.

Domestic Water Piping:
Building service piping underground 4" and larger shall be push-on-joint ductile iron pipe with standard pattern push-on-joint fittings, and gasketed joints.

Building service piping underground 3” and smaller shall be soft copper tubing, ASTM B 88, type L, wrought-copper solder-joint fittings and soldered joints.

Aboveground domestic water piping larger than 4” shall be hard copper tube, ASTM B 88, Type L wrought-copper solder-joint fittings and brazed joints. Piping may also be galvanized steel pipe, galvanized-steel-pipe appurtenances; and grooved joints.

Aboveground domestic water piping 4” and smaller shall be hard copper tube, ASTM B 88, Type L wrought-copper solder-joint fittings and soldered joints.

Pro-Press fittings are acceptable for aboveground domestic water piping 2” or smaller but each installation needs review / approval prior. Pro-Press fittings should not be used behind drywall or other locations where it is not accessible.

Domestic Water Specialties:
Reduced pressure backflow preventers, by Watts Industries, Inc., shall be provided for all building water services. Double-check backflow preventers by Watts Industries, Inc. shall be used where permissible for all other make-up water connections.

Water pressure-reducing valves, by Watts Industries, Inc., shall be provided where required on building water services. Furnish with appropriate service valves on each side of the backflow or check valves to permit for easy servicing.

Trap seal primers shall be furnished on all floor drains.

Arrange and valve all utility services so that each floor and lab can be isolated without interrupting service to other parts of the building.

Arrange and valve domestic hot and cold water piping so that restrooms can be isolated without interrupting service to other parts of the building.

Water hammer arrestors shall be provided on all quick closing valves in compliance with PDI-WH-201.

Storm Drainage Piping:
Aboveground storm drainage piping 4” and smaller shall be hubless cast iron pipe and fittings, standard shielded, stainless steel couplings; and hubless-coupling joints.

Aboveground storm drainage piping larger than 4” shall be hubless cast iron pipe and fittings, heavy duty shielded, stainless steel couplings; and hubless-coupling joints.

Underground storm drainage piping shall be PVC. Cast iron hub and spigot pipe was previously used with cast iron fittings, heavy duty shielded, stainless steel couplings; and hub coupling joints.

Sanitary and Waste Vent Piping:
Aboveground sanitary waste and vent piping 4” and smaller shall be hubless cast iron pipe and fittings, standard shielded, stainless steel couplings; and hubless-coupling joints.

Aboveground sanitary waste and vent piping larger than 4” shall be hubless cast iron pipe and fittings, heavy duty shielded, stainless steel couplings; and hubless-coupling joints.

Underground sanitary waste and vent piping shall be PVC.

Laboratory waste piping should match one of the types described here. In Mudd Building laboratory waste is carried by fire-retardant polypropylene (FRPP) Type 2 from Orion. This is a

blue pipe rather than standard white PVC. At MTC, Duriron pipe was originally used for laboratory waste although other types have been used as replacements since Duriron is no longer available. Glass pipe would also be acceptable although it has not yet been used on campus.

Natural Gas Piping:
Indoor aboveground piping 2" and smaller shall be steel pipe with malleable-iron fittings and threaded joints.

Indoor aboveground piping larger than 2" shall be steel pipe with malleable-iron fittings and welded joints.

Outdoor underground gas piping can be made of HDPE with approved plastic fittings installed according to industry standards such as ASTM F2619, "Standard Specification for High Density Polyethylene (PE) Line Pipe". Previously, outdoor gas piping was made of steel pipe with malleable-iron fittings and threaded joints or steel pipe with wrought-steel fittings and welded joints with protective coatings applied over piping to cover, seal, and protect piping and joints.

Fossil-fuel-burning equipment (e.g., large boilers or emergency generators) may need a permit from the Pennsylvania Department of Environmental Protection prior to being installed; see a separate document from IES Engineers entitled "Environmental Requirements for New Construction Projects" for more information.

Plumbing Fixtures:

Water closets shall be a white vitreous china, wall mounted fixture as manufactured by Kohler, Toto, or American Standard. Automatic, hard-wired flush valves. Mount fixtures at ADA height where required. Provide with molded, solid plastic, open front seat without cover. Example flush valve product: Toto Model TET1LN.

Urinal shall be a white vitreous china, wall mounted fixture as manufactured by Kohler, Toto, or American Standard. Automatic, hard-wired flush valves. Mount fixtures at ADA height as indicated. Example product: Toto Model TEU1UN.

Arrange and valve all utility services so that each floor and lab can be isolated without interrupting service to other parts of the building.

Arrange and valve domestic hot and cold water piping so that restrooms can be isolated without interrupting service to other parts of the building.

Place valves on each side of the backflow or check valve to permit servicing.

Provide water hammer arrestors in water lines to equipment or fixtures having quick closing or flush valves and any equipment that might produce water hammer.

Lavatories shall be a white vitreous china, wall mounted fixture as manufactured by Kohler, Toto, or American Standard. Faucet shall be deck mounted, single lever faucet with automatic, hard-wired control. Mount fixtures at ADA height as indicated. Example product: American Standard Nextgen Selectronic.

Sinks shall be stainless steel drop in by Elkay, Model LRAD. Faucet shall be deck mounted, with rigid gooseneck, and dual lever wrist blades for manual operation. Faucet shall be Chicago Faucet, Model 985-317GN2A. Faucets shall be installed with plumber's putty, and not plastic inserts that may come with the faucets.

Mop receptors shall be floor mounted, molded stone with integral drain molded into a one-piece unit. Provide with chrome plated service faucet with vacuum breaker, integral stops, adjustable wall brace, pail hook, mop hangers, ¾' hose thread on spout, and stainless-steel wall guards. Mop receptor shall be by Fiat, Model MSB.

Electrical water coolers with bottle-filling stations shall be bi-level, one ADA and one standard height. Coolers shall be refrigerated to generate 9 gph, 80 F inlet and 50 F outlet water. Touchless, filtered water coolers shall be Elkay EZH$_2$0 (e.g., LMABFTL8WSLK).

Lehigh provides soap dispensers for bathroom sinks.

Domestic Water Circulating Pump:
Hot water recirculating pumps shall be close-coupled, in-line, seal less centrifugal pump as manufactured by Bell & Gossett. Pump and motor assembly shall be hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally. Casing shall be bronze, with threaded companion-flange connections. Impeller to be corrosion-resistant material and motor shall be single speed unless otherwise noted.

For several recent LEED projects, Lehigh has had water submeters installed to verify water model assumptions.

DIVISION 23 – HVAC

HYDRONIC SYSTEMS - BUILDINGS:

Four-pipe systems are required in all buildings requiring simultaneous heating and cooling, based on building size, orientation, and building space program needs.

Where modifications are made to existing buildings already served by two-pipe systems, two-pipe changeover designs will be considered, where it is determined this design will not impact the planned program needs of the space.

If connecting a new variable-flow system to an existing changeover or constant-volume systems, provide 2-way injection valves on the primary side supply line and modulate these valves to maintain the desired secondary side HW or CHW temperature setpoint.
Preheat coils on large air handlers shall be provided with freeze pumps to protect against freezing and temperature stratification.

For systems requiring freeze protection, when other design methods are ineffective, utilize 33% concentration Ethylene Glycol (specific products are identified below). Proposed glycol system use shall be reviewed in the Design phase.

Provide vents at the high point of all piping systems, in accessible locations, to allow for system venting. Each floor should have isolation and drain valves. All vents shall have isolation valves. All access areas in hard ceilings should be a minimum of 18"
Closed-Loop Hydronic Systems:

Expansion tanks shall be diaphragm type; the pre-charge pressure shall be specified to suit the system.

Air separators shall be installed in each heating system distribution loop at the point of lowest air solubility and vented to atmosphere. Spirovent preferred

A chemical pot feeder shall be installed across the hot water pump.

Gauges:

1. Provide differential pressure gages at all pumps;
2. Gauges shall be glycerin-filled.
3. All gauges on a common hydronic system shall have consistent scale ranges.
    - Provide isolation “pete” plug valves on all gauge connections.
    - Provide temperature indicators on the supply and return side of all heat exchangers, chillers and boilers. All gauges shall have consistent temperature ranges.
    - Provide pressure gauges on the supply and discharge sides of all pumps and heat exchangers.
4. Piping systems shall be pressure-tested before installation of insulation. Pressure tests shall be witnessed by Lehigh University personnel and documented by the contractor.
5. All systems feeding outdoor units (e.g., chillers, air handlers, etc.) shall be glycol type to prevent freeze issues

Chilled Beams

Chilled beams are prohibited in residential facilities and any other application requires University Facilities Approval.

Deviations from the requirements listed in this section require University Facilities approval in writing.

When chilled beams are used throughout the building or at least most areas, the vapor barrier is critical for the building exterior. (If they are used in just limited areas, then the vapor barrier is indispensable around those specific areas.)

Chilled beams are to be in conformance with manufacturer’s recommendations. Many of the selection programs will check the layout to verify that air velocities and expected temperature gradients are all within acceptable range.

Chilled beams are to be supported from structure with straps, hangers or uni-strut. Support via ceiling grid is not applicable.

A/E to confirm supply air temperature to active type chilled beams and coordinate with chilled beam manufacturers provided in specifications. Some chilled beams have the capability of going as low as 55°F, while others require a room temperature of 72°F (neutral air temperature).

Static air pressure drop to be below 0.5 inches and noise level below NC 30 (NC 25 is better and normally very achievable with the proper selections) with acoustical testing in accordance with ANSI S12.51.

Water pressure drop to be below 10 feet and flow velocities not to exceed 4 fps.

Supply air ductwork can be connected in series up to two (2) chilled beams with some manufacturers, three (3) chilled beams with others. A/E to coordinate selections and connections with approved chilled beam manufacturers provided in specifications.

Coordinate locations and layout of chilled beams verses heat producing equipment or exhaust hoods if present. Chilled beam layouts shall not compromise light fixture distribution.

Supplemental supply air devices, if present, should not blow directly into supply air from the chilled beams.

Provide “wing walls” to chilled beams located in areas with exposed structure (no ceiling). Product shall be a manufacturer accessory.

Locate returns/exhausts in line with the ends of the chilled beams, if possible.

Provide a separate chilled water supply branch to each zone of temperature control, with an automatic valve, strainer, and isolation valve. The return branch should have a circuit setter and isolation valve. Automatic valve shall be integrated with Building Automation System.

Waterside should always be individual connections for each chilled beam.

Each individual chilled beam should have a circuit setter, and branch circuits isolation valves.

Automatic controls are to be in place to maintain a chilled water temperature 3°F above dew point, with mixing valve. A humidity sensor doesn't need to be installed in all spaces, however, a sampling of typical spaces or at least one of each type of space. The BAS needs to calculate dew point after measuring RH.

Reverse return loop is not that critical provided that balancing valves are provided where required.

Provide condensation sensors as a backup in case the BAS sequences fail.

When rooftop air handling units provide different summer and winter supply air temperatures, all chilled beams are to be a four (4) pipe configuration.

Access to all chilled beam serviceable components (filters, valves, etc.) must be provided, and must be serviceable by only one person.

Where chilled beams are located near outside doors and operable windows, they must have condensate drains piped to drain.

Approved manufacturers are Trox, Semco, Titus, Price, Kruger and Dadanco. (Dadanco chilled beams have a higher output capacity than the other manufacturers. Confirm the chilled beam layout based on all approved manufacturers.)

Design Conditions:
Interior design temperatures:
Summer: 74 deg. F. Winter: 70 deg. F.

Outdoor design temperatures:
Summer: 91 deg. F DB / 73 deg. F. WB Winter: 0 deg. F.

Campus central steam plant operates year-round. Campus central chilled water plant operates from approximately April 15th thru November 15th, depending upon when seasonal temperatures change.

Ensure that accessibility is maintained when designing equipment, piping, and ductwork. Provide walk-around space and ensure coil/filter pull in all mechanical rooms. In areas with drywall ceiling, be sure to accommodate access to balancing dampers, control valves, filters, etc.

Demolition:
In areas of renovation, disconnect, demolish, and remove all HVAC systems, equipment, and components where indicated. Ductwork and piping shall be removed in its entirety. No systems, ductwork, equipment, or piping shall be abandoned in place. Equipment that is to be removed and salvaged, shall be labeled and tagged by the contractor, and delivered to a location as determined by Lehigh University. All demo should be inspected by Lehigh personnel to verify what was removed prior to new work.

Expansion Fittings and Loops for HVAC Piping:
Flexible, stainless steel braided hose, expansion loops shall be used for copper and Schedule 40 black steel heating hot water piping systems. Expansion loops shall be limited to Metraflex Inc., Flex-Hose Co. Inc., or Flexicraft Industries.

Meters and gauges for HVAC piping:
All steam meters shall be Armstrong Veris Accelebar AFS and use pressure and temperature compensation to measure mass flow (in lbs/hr). The meter shall include an RTD (resistance temperature detector). The Veris meter shall be installed with a separate KEP ES749 Steam Metering Flow Computer that uses a 4-20mA signal to report steam flow and generates a pulse for every 1,000 lbs of steam. These results for both instantaneous flow (lbs/hr) and totalization (lbs) should be transmitted to the building DDC system's designated front-end screen. The pipe size entering the meter shall be reduced one pipe size to increase the measurable velocity.

General-Duty Valves for HVAC piping:
All brass or bronze ball valves shall be two-piece full-port type with stainless steel trim.

High performance butterfly valves shall be limited to Cooper Cameron, Crane Co., DynaCentric, Jamesbury, Victaulic, or WKM. Main isolation valves for buildings served by district steam and chilled water should be a Jamesbury 815 series valve (i.e., 815L-11-2236-TT).

Heat Tracing:
Any chilled water or heating hot water piping (non-glycol) exposed on the building exterior shall be heat traced with self-regulating, parallel resistance heating cables. All heating tracing shall be monitored and alarmed by the building DDC system. The heat trace cable must be sized using the manufacturer's standard procedure and shall maintain fluid within the pipe at 40 deg. F. when the outside temperature is minus 10 deg. F. Acceptable manufactures shall be Thermon Manufacturing, Raychem Corporation, or Nelson Electric Manufacturing Co.

Identification for HVAC Piping and Equipment:
All ductwork and piping shall have adhesively applied labels identifying the system service and using arrows indicating direction of flow. Lettering size shall be at least 1 ½" high. Labels shall be spaced at intervals of 25 feet.

Equipment labels shall be black plastic type with white lettering, with pre-drilled holes for attachment hardware. Minimum letter size shall be ¼".

<u>Redundancy</u>
Redundancy of HVAC systems is important for critical systems, and should be discussed during the Design phase. At a minimum, redundancy shall be provided for the following HVAC system components:

- Heating Hot Water Heat Exchangers - provide two (2) heat exchangers, each capable of handling fifty percent (50%) of the system capacity. Each heat exchanger shall have two (2) steam control valves to provide for a full range of steam flow controllability. Where possible each unit and its components should be 100% for redundancy.
- Heating Hot Water Pumps - provide two (2) pumps, each capable of handling one hundred percent (100%) of the system capacity
- Chilled Water Pumps - provide two (2) pumps, each capable of handling one hundred percent (100%) of the system capacity.
- Tower Water Pumps - provide two (2) pumps, each capable of handling one hundred percent (100%) of the system capacity

Testing, Adjusting, and Balancing for HVAC:
On all renovation projects, it is a requirement that the consulting engineering firm clearly specify a pre-balance report, performed by an independent Testing & Balancing Agency, on all existing supply, return, or exhaust air systems that are scheduled to be reused, to assure of adequate capacity upon completion of the renovated spaces. This would apply to any chilled water or heating hot water systems as well. Old or previous project balance reports should not be used.

HVAC Insulation:
All indoor supply, return, or outside air ductwork concealed above finished ceiling shall be wrapped with 2" thick, 1.5 lb./cu. ft. density duct wrap insulation. Supply diffusers should be the insulated type. Internally insulated ductwork is prohibited.

All indoor supply, return, or outside air ductwork exposed in Mechanical Rooms shall be wrapped with 2" thick, 1.5 lb./cu. ft. density rigid mineral-fiber board insulation.

All indoor supply, return, exhaust, or outside air ductwork in attic spaces shall be wrapped with 3" thick, 1.5 lb./cu. ft. density duct wrap insulation.

All supply, return, or outside air ductwork exposed on the building exterior shall be wrapped with 2" thick, 6 lb./cu. ft. density rigid mineral-fiber board insulation, with 0.060 inch thick rubberized, white EPDM jacket.

All unused portions of louvers where blanked off with sheetmetal shall be insulated with 1 ½" thick, 1.5 lb./cu. ft. density, rigid mineral-fiber board insulation.

All indoor chilled water piping shall be insulated with mineral-fiber, pre-formed pipe, type 1: 1" thick for nominal pipe size of 1 ½" and less and 1 ½" thick for nominal pipe size greater than 1 ½".

All indoor heating hot water piping shall be insulated with mineral-fiber, pre-formed pipe, type 1: 1" thick for nominal pipe size of 1 ½" and less and 2" thick for nominal pipe size greater than 1 ½".

All outdoor, above ground chilled water or heating hot water piping shall be insulated with cellular glass insulation 3" thick, with outdoor field applied aluminum jacket. Aluminum jacket shall be corrugated type, 0.16" thick.

All indoor high pressure (125 psig and greater) steam piping shall be insulated with mineral-fiber, pre-formed pipe, type 1: 2 ½" thick for nominal pipe size of 1" and less, 3" thick for nominal pipe size 1" to 4", and 3" thick for nominal pipe size greater than greater than 4".

All indoor medium pressure (16 psig to 124 psig) steam piping shall be insulated with mineral-fiber, pre-formed pipe, type 1: 2" thick for nominal pipe size 1" and less, 2 ½" thick for nominal pipe size 1" to 1 ½", and 3" thick for nominal pipe size greater than greater than 1 ½".

All indoor low pressure (15 psig and less) steam piping shall be insulated with mineral-fiber, pre-formed pipe, type 1: 1 ½" thick for nominal pipe size 1 ½" and less, and 2" thick for nominal pipe size greater than greater than 1 1/2".

All indoor steam condensate piping shall be insulated with mineral-fiber, pre-formed pipe, type 1: 1 ½" thick for nominal pipe size 1 ½" and less, and 2" thick for nominal pipe size greater than greater than 1 1/2".

All chilled water pumps housings shall be insulated with 2" thick, 2 lb./cu. ft. density mineral-fiber board insulation.

All chilled water expansion/compression tanks shall be insulated with 1" thick flexible elastomeric insulation.

All heating hot water expansion tanks shall be insulated with 1” thick mineral-fiber pipe and tank insulation.

All chilled water air separators shall be insulated with 1” thick flexible elastomeric insulation.

All heating hot water air separators shall be insulated with 2” thick mineral-fiber pipe and tank insulation.

In areas where chilled water or heating hot water piping is exposed in the space, up to seven feet above finished floor, shall have a PVC jacket on top of the fiberglass pre-formed pipe insulation for durability and protection.

All refrigerant piping shall be insulated with 1” thick flexible elastomeric pipe insulation.

All cooling condensate piping shall be insulated with 1” thick flexible elastomeric or 1” thick mineral-fiber pipe insulation.

All indoor emergency generator engine exhaust and silencer piping shall be insulated with 4 ½” thick calcium silicate pipe insulation.

Instrumentation and Control for HVAC:
The automatic temperature controls contractor shall be either Siemens Building Technologies or Honeywell. All naming configurations for panels and database shall be verified by Lehigh Facilities.

Thermostats must restrict settings to 70 deg. F. to 76 deg. F. for night setback and 68 to 76 for daytime settings.
In dormitory areas with fan coil units, all new thermostats must have dial control capability for space temperature. Slide control for fan speed must have auto, off, low speed, medium speed, and high-speed capability. Each bedroom shall have its own fan coil and thermostat.

Airflow measuring stations shall be limited to Ebtron Gold Series model GTX116.

If remote occupancy sensors will be used to control space temperature, hardwire the sensors to the local unit controllers.

Hydronic Piping:
All above ground chilled water or heating hot water piping, 2” or less, shall be cooper tubing with wrought copper fittings and soldered joints. The use of Pro-Press fittings in certain buildings is acceptable upon approval by the Lehigh University Facilities Services, Campus Planning, and Projects Department and only in accessibly areas not behind walls or above hard ceilings. The use of T-Drill method for pipe fitting is not acceptable on any project.

All above ground chilled water or heating hot water piping, greater than 2”, shall be Schedule 40 black steel with welded fittings or groove lok and must be accessible. The use of grooved mechanical fittings and couplings shall be limited to Victaulic, and shall be installed above accessible ceilings. The use of Victaulic fittings and couplings shall not be allowed in piping chases or above drywall ceilings.

Cooling condensate drain piping shall be copper tubing with wrought copper fittings. In the City of Bethlehem cooling condensate piping may not be connected to the sanitary sewer system. All cooling condensate must tie into rainwater conductors or be extended to grade.

In-line air separators for all chilled water or heating hot water systems shall be limited to Spirotherm Spirovent model VSR or VHR.

For chilled water or heating hot water systems requiring glycol freeze protection, Dowtherm SR1 ethylene glycol, minimum 35% by volume or Interstate Chemical Intercool OP-100, minimum 43% by volume, shall be used for minus 18 deg. F protection. In a food-service environment, propylene glycol can be used.

Hydronic Pumps:
For small in-line pumps, close-couple type shall be specified. For larger in-line pumps, mount in the vertical position to minimize stress on pump seal and couplings. Pump manufacturers shall be limited to Bell & Gossett, Armstrong Pumps, Inc., or Taco, Inc.

Flexible-coupled, base mounted, end suction pump manufacturers shall be limited to Bell & Gossett, or Taco, Inc.

Cooling condensate pumps shall be limited to Little Giant model VCL 14ULS and shall be furnished with a safety switch and check valve assembly for overflow protection. In areas where the condensate pump needs to be installed in an exposed condition, the pump shall be installed within a Hoffman Products in-line EMC, type 1 steel enclosure with lockable access door. All pumps must be accessible for PM and replacement.

Steam and Condensate Heating Piping:
All above ground low-pressure steam piping shall be Schedule 40 black steel, type S, grade B with class 125 cast-iron fittings and threaded joints. All above ground steam condensate piping shall be Schedule 80 black steel, type S, grade B with class 125 cast-iron fittings and threaded joints. Pipe flange gasket material shall be spiral wound with graphite filler as manufactured by Flexitallic style CG or LS.

Steam pressure reducing valves shall be limited to Spirax-Sarco. Spence Engineering is not an acceptable manufacturer.

Steam traps in student bedrooms shall be limited to the Tunstall Corporation. In the Drinker-Dravo and Richards buildings, Spirax-Sarco float & thermostatic shall be specified. On main lines

Steam condensate pumps shall be limited to Hoffman ITT and shall be duplex type.

All underground steam and condensate piping shall be Insul-8 Conduit System as manufactured by Rovanco Piping Systems, Inc. The steam carrier pipe shall be Schedule 40 A53B ERW steel pipe. The condensate carrier pipe shall be Schedule 80 A53B ERW steel pipe. The carrier pipe insulation shall be mineral wool conforming to ASTM C547 with a k-value of no greater than 0.29 at 200 deg. F. The outer conduit shall be 10 gauge welded steel conforming to ASTM A139 with an exterior coating of Rhinocoat fusion bonded epoxy applied to a thickness of 20 mils.

Water Treatment:
All Campus water treatment shall be performed by the following:
Proasys Managed Water Solutions Inc.
318 Hendel Street
Shillington, PA 19607
Contact: Bernie Kiefer, CWT
Phone: (610) 775-1505.

Metal Ducts:
Duct construction, including sheet metal thickness, seam and joint construction, reinforcements, hangers, and supports shall comply with SMACNA's "HVAC Duct Construction Standards" for static-pressure classes and leakage classes.

All low pressure ductwork shall be joined with transverse joints with prefabricated galvanized Ductmate sections of TDF or TDC type flanged transverse joints with bolted corners, gaskets, and sealants constructed in accordance with SMACNA standards.

All ducts exhausting humid air from dishwashers, glasswashers, or showers, shall be constructed of type 316 welded stainless steel. Provide a drain pipe, extended to an indirect waste connection at all low points of the ductwork.

All exhaust air ductwork associated with laboratory fume hood exhaust air systems shall be constructed of type 316 welded stainless steel and shall be able of withstanding temperatures of -40 deg. F. to 250 deg. F. and capable of withstanding air velocities of 3600 fpm, and positive or negative pressures to 6" w.c.

The use of flexible ductwork shall be limited to supply air systems and shall be limited to a maximum length of 6'-0". The use of flexible ductwork in return air or exhaust air systems is prohibited. Flexible duct shall be a factory glass fiber insulated assembly with vapor barrier jacket and a maximum thermal conductance of 0.23 btu/hr./sf./deg. F. at 75 deg. F. The duct shall be factory made and composed of a CPE liner permanently bonded to a coated spring steel wire helix for a positive working pressure of at least 10" w.c. Acceptable manufacturers shall be Flexmaster, Thermaflex, or Genflex.

Auxiliary drain pans under horizontal air handling units, fan coil units, duct coils, electrical equipment, etc. shall be constructed of 16 gauge galvanized steel sheetmetal with all joints brazed. Construct pans watertight with hemmed edges. Extend the auxiliary drain pan at least 6" beyond the equipment it is serving and be at least 2" high. Provide a drain connection of at least ¾" type L copper tube and extend to nearest equipment room floor or to the building exterior. The drain pan must not impede on the filter access or service maintenance clearances. Unit drain pan or aux drain pan shall have a unit cut off switch or input back to BAS.

Air Duct Accessories:
All fire dampers shall be specified as Type B curtain type, with the blades installed outside of the air stream and shall be approved for use in dynamic systems. Provide with U.L rated 165 deg. F fusible link. Dampers must lock in the closed position. Acceptable manufacturers shall be Ruskin, Prefco, or Imperial.

Chillers:
The Trane Co or Diakin/Mcquay is the preferred manufacturer for all chillers. Carrier, York, or other will be evaluated by the Lehigh University Facilities Services, Campus Planning, and Projects Department in certain instances. The chiller must control the chilled water pump operation and shall be monitored by the DDC system. All Trane Co. chillers require a "winter mode" to circulate water thru the chiller barrel to prevent a freeze condition. The mode will require the chilled water pump to operate.

Indoor Air Handling Units:
Indoor air handling units shall be limited to Trane Co., Carrier, York, or Daikin-McQuay. All units shall be made of double-wall construction. If units are located above an accessible ceiling, the units must be furnished with an auxiliary drain pan and unit cut off switch or input back to the BAS.

"Comefri" SKF bearings mounted vertically leak grease and must be avoided.

Plastic motor actuators on steam heating coils cannot be specified.

All chilled water coils shall be specified with basis of design 48 deg. F. entering water temperature.

Fan Coil Units:
Fan coil units shall be limited to Trane Co., Carrier, York, or Daikin-McQuay. If units are located above an accessible ceiling, the units must be furnished with an auxiliary drain pan. At a minimum, the drain pan must be the full length and width of the cooling coil, but must not impede on the filter access or service maintenance clearances. Pan switches in each pan when in office or bedroom spaces.

On all vertical, exposed type fan coil units, specify with manufacturer's extended pipe cabinet to allow for 2-pipe or 4-pipe coil control valve access and maintenance.

Ductless Split System Air Conditioning Units:
Mitsubishi is the only acceptable manufacturer. Minimum SEER 18 with a network compatible option. The unit shall be specified for low ambient operation.

Ductless split system units shall be provided where advisable from an engineering standpoint, such as for spaces requiring extended cooling seasons or interior spaces without widows that will have year round load.

Variable Frequency Drives:
ABB model ACH550 or ACH580 are the only acceptable manufacturer and models and shall be specified with an integral disconnect switch. Any motor 20 horsepower and above shall be specified with factory installed grounding rings.

Laboratory Fume Hood Controls:
Siemens Building Technologies is the only acceptable manufacturer. Room/Corridor static pressure relationship shall be set for 0.05" w.c. Associated exhaust fans shall be controlled with occupancy sensors. Time delay is needed for Keltron system before activation of the evacuation strobes.

DIVISION 26 – ELECTRICAL

Demolition:
In areas of renovation, all devices, equipment, associated conduit supports, and wiring no longer required, shall be removed to the panel of origin or the boundary of the project area. Where portions of the existing branch circuits are removed, maintain continuity of circuiting to the remaining devices. Where empty conduits remain, install a pull string and identify at both ends. Lehigh University shall be given the opportunity to retain ownership of any or all removed materials and equipment. All such items shall be carefully handled and protected and shall be stored by the electrical contractor at the site or as directed by Lehigh University. Any such materials and equipment not desired by Lehigh University shall become the property of the contractor and shall be removed. Removal of all fire alarm, communications, data and security equipment and associated cabling shall be coordinated with building operating personnel. Existing building fire alarm system shall remain in operation during both demolition and construction stages of the project.

Electrical Distribution Equipment:
All electrical equipment shall be based off Lehigh University preferred manufacturer, Square D. GE, Eaton, and Siemens will be evaluated by Lehigh University as an approved equal.

Distribution and Branch Circuit Panelboards:
Panelboards shall be 208/120V or 480/277V, 3 phase, 4 wire configuration with copper bus bars of ratings indicated on contract drawings, full or 200% size neutral bus bars if indicated on contract drawings and separate ground buses bonded to panel enclosure. Provide additional ground buses electrically isolated from the panel enclosure where indicated on the panelboard schedules. Where feeder neutral is oversized, neutral bus ampacity shall be increased accordingly. Cable lugs shall be mechanical or compression type. Feed-through lugs and cable connections shall be provided for multiple section panels. Panelboard enclosures shall be galvanized code gauge steel. Trims shall be surface type in unfinished spaces and flush type in finished spaces, with door-in-door construction and ANSI 61 gray enamel finish. Doors shall be lockable and all locks shall be keyed alike. Furnish two keys for each panel. Finish typewritten directories mounted behind frame inside door under a plastic window. All electrical panels/breakers must be labeled for final destination/room number. Engraved nameplates shall be furnished for each panelboard. Circuit breakers shall be molded case, bolted-in place with thermal-magnetic trip element. Plug-in type circuit breakers will not be acceptable. Circuit breakers serving HVAC equipment shall be HACR rated. Main circuit breakers shall be mounted separately from branch breakers at top or bottom. Unless otherwise noted panelboard short circuit rating shall conform to U.L. standards for fully rated systems only (series rated panels will not be acceptable unless specifically indicated). Minimum interrupting ratings shall be as shown on drawings or specifications.

Transformers:
Step-down transformers shall be totally enclosed, copper winding, ventilated dry type with 480 volt delta primary, 208/120 volt wye configured three phase, temperature rise of 80 degrees Celsius, four-wire secondary and full load rating as indicated on contract drawings. Transformers shall be furnished with two (2) 2-1/2% taps above and four (4) 2-1/2% taps below rated voltage. The final transformer at the end of a campus feeder shall include a lighting arrestor. Wire type between Lehigh's distribution system and a new building transformer should be #2 or #2/O.

Raceways:
Conduits:
Minimum conduit size shall be ¾" trade size

Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit IMC.

2. Concealed Conduit, Aboveground: IMC, EMT.
3. Underground Conduit: RNC, Type EPC-40 -PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
8. Flexible metal conduit (MC) may be used for interior lights fixtures above suspended ceilings and connections to vibrating equipment, such as motors. The maximum usage is 30 amps.

Surface Raceway:

Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish and color selected by Architect.

a. Legrand Manufacturer, Wiremold

Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

b. Legrand Manufacturer, Wiremold

Generators:
Generators shall be based on Lehigh University's preferred manufacturer, Kohler Power Systems. Other manufacturers must receive prior approval from Lehigh University. Control via remote start/stop and running status of emergency generators shall be monitored and controlled from the associated building DDC system's designated front-end screen. Generators shall be natural gas type based on the physical location on campus. All generator locations must be coordinated and approved by Lehigh University. Certain areas of campus have low gas pressure and must be reviewed accordingly with Lehigh University and UGI. In these specific areas, an alternate diesel type generator shall be used with sub-base tank capacity of 72 hours at 100% load. Generator enclosures shall be weather-proof type with sound attenuation and shall be used with exhaust silencer mufflers to reduce the generator noise output to a maximum of 52db at 7 meters from the generator. Generators shall be provided with automatic digital voltage regulators. All generators need a permit from the Pennsylvania Department of Environmental Protection prior to being installed; see a separate document from IES Engineers entitled "Environmental Requirements for New Construction Projects" for more information.

Automatic Transfer Switches 'ATS':
Automatic Transfer Switches shall be Kohler, Russ Electric or ASCO. Typical switches shall be 3-Pole with closed transition transfer (CTT). Transfer switches shall be tied into the buildings DDC system to provide transfer switch status "Normal or Emergency mode" from a remote location. Lehigh runs and tests its emergency generators monthly.

Building Electric Metering:
A multi-function meter shall be provided on the electrical service to the building. The meter manufacturer shall be Shark Model 200 (or MP200 to monitor subsystem loads) with universal voltage input, multi-function metering, advanced data logging, power quality, and communication integration. Shark 200 meters are voltage specific and order numbers are as follows.

Shark200-60-10-V2-D2-INP100S-X-X (Shark 200 without box)
ENCHSHK200-277-60-10-V2-D2-INP00S-X (Enclosed Shark200-277)
ENCHSHK200-120-60-10-V2-D2-INP00S-X (Enclosed Shark200-120). LAN connections must be provided.

The digital meter shall be tied into the Lehigh University network (and not the BAS) to provide the ability to monitor the multi-function meter from a remote location.

For several recent LEED projects, Lehigh has had electric submeters installed to verify energy model assumptions.

Electrical Device, Wire, and Equipment Labeling:
All wires shall be identified by panel and circuit number at all termination and splice points by the use of Brady b-500 vinyl cloth tape or equivalent method.

All junction boxes shall be identified with panel and circuit numbers of all circuits or name of communications system cabling contained within. Junction boxes in exposed locations shall be clearly marked with labels. Junction boxes in concealed locations shall be marked with a bold indelible marking pen. Lettering shall be neatly and legibly printed. Junction boxes on emergency service shall be painted red and labeled as emergency.

Panelboards, disconnect switches, starters and equipment enclosures shall be identified with engraved black and white plastic nameplates indicating equipment served, voltage and ampere rating and incoming feeder designation. Nameplates shall be fastened with two counter sink oval head screws.

All wiring devices; i.e. light switches, receptacles, etc. shall be labeled/identified with the panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

Conduit runs for branch circuiting and/or communications cabling shall be identified at every 50 feet of length with circuit number or system name.

Existing Building Renovations Cutting/Patching walls and ceilings:
Where the Electrical Contractor is required to pull new wiring through existing walls and hard ceilings, the contractor shall reuse existing backboxes and wiring (if applicable) to fullest extent possible.

Where wiring cannot be pulled through the existing wall/ceiling the Electrical Contractor shall coordinate all cutting of the existing ceilings and walls to route new wiring with all other trades.

The Electrical Contractor shall use the existing access panels where applicable and provide new access panels as required to pull new wiring to avoid using surface raceway.

The Electrical Contractor shall patch and paint all new cutting to match the existing areas being disturbed.

Electrical System Studies:

Arc-Flash Study:
An Arc Flash Hazard Study will be performed for the electrical distribution system shown on the single-line electrical design drawings by Orion Technical Services LLC. Lehigh University will be responsible for providing these services, U.O.N. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the single-line drawing. This includes switchgear, switchboards, panelboards, motor control centers, paralleling gear, and transformers. This study will also state the total number of arc flash labels (locations with calculations) that will be supplied by Orion. The Arc Flash Hazard Warning Labels serve as a guide to assist technicians and others in the selection of proper Personal Protective Equipment when working around exposed and energized conductors. The electrical contractor will install the labels.

This study will be performed once the single-line drawing and all of the relevant electric system component submittals have been shared with Lehigh University and Orion.

Fault Coordination Study:
A complete coordination study for system protection will be performed by Orion Technical Services LLC. Lehigh University will be responsible for providing these services to perform the coordination study, U.O.N. Fault current calculations will be provided for the entire system.

The fault protection and coordination study shall include the following information:

Calculated available fault currents at all equipment busses and overcurrent protective devices in the system. Values shall be calculated for 3 phase bolted fault conditions. The current limiting effects of fuses shall be demonstrated in the report.

Complete sets of time-current coordination curves, starting with devices at the point of service through to the branch devices in each item of equipment at the lowest levels of the distribution system.

A complete set of motor starting time-current curves for motors exceeding 50 horsepower based on the Wk^2 inertia of the driven load.

A complete set of transformer inrush and thermal withstand curves.

A tabulation of all recommended relay settings including ground fault relay settings, fuse sizes and classes and circuit breaker trip settings; identifying each item by Manufacturer and catalog number.

A tabulation of any cases where selective coordination is not obtainable and a description of the consequences of a downstream fault on continuity of service.

Upon approval of the final study by the testing company, the Electrical Contractor shall adjust protective device settings for new and existing protective devices in the affected equipment in accordance with the values recommended in the report.

The final selection of protective devices for all new equipment furnished under this Contract shall be based on the approved study. This study is performed at the same time as the Arc-Flash Study.

Lighting
The purpose of this standard is to outline the criteria to be used in designing new exterior lighting on campus in order to create a safe and visually cohesive lighted environment in accordance with the Lehigh University Academic Lighting Master Plan Executive Summary, Residential Lighting Master Plan Executive Summary, and Site Lighting Design Criteria, prepared by The Lighting Practice in 2014 and can be found in LU Facilities Design Standard & Guidelines, Appendix: Other Guidelines, Standards and Policies.

All luminaires shall minimize uplight and glare. Backlight shall also be controlled when a luminaire is installed adjacent to property not owned by Lehigh University.

Full cut-off sources should be used for building entries and perimeter lighting. Fixtures at doorways should not exceed 10W(LED). Building perimeter lighting should not exceed 20W(LED). Wattage requirements may depend on actual application and illuminance requirements. The use of building and pole mounted floodlights for general area lighting is prohibited.

Interior / Exterior Color Temperatures
The following chart summarizes the desired color temperature (in K) for different types of spaces. Any exceptions to this chart require prior approval by Lehigh University.

INTERIOR SPACES	Lehigh Lighting Color Temperature Standard (K)
Bedrooms	3,000 – 4,000
Auditoriums	3,500
Conference Rooms	3,500
Dining Halls	3,500
Libraries	3,500
Lobbies	3,500
Offices - General	3,500
Classrooms	4,000
Computer Rooms	4,000
Corridors	4,000
Gymnasiums	5,000
Kitchens	4,000
Laboratories	4,000
Offices - Meticulous tasks	4,000
Production/Assembly/Shop Areas	4,000
Paint Spray Booths	5,000

EXTERIOR SPACES

Parking Lots	4,000
Street Lights Victorian	4,000
Street Lights Modern	4,000
Street Lights at Mountaintop Campus (Original Bethlehem Steel Fixtures)	5,000
Walkways	4,000

Note:

Use 4,000K when 3,500K bulbs are not available.

Light Fixtures:

The selection of lighting fixtures for the proposed building or renovation will offer energy efficiency and Architectural style while providing both the desired quality and quantity of light within the IECC's allowable power densities (Watts per sq. foot). The Illuminating Engineering Society (IES) recommended foot-candle levels will be followed for lighting layouts.

Stairwells shall have 1'x4' linear LED, ceiling/wall mounted fixtures or other Lehigh approved LED fixture with integral emergency battery inverters (if applicable). Stairwell fixtures shall be unswitched and remain on as night lighting. Building vestibules will be provided with recessed, open, LED downlights housing integral inverters for emergency fixtures (if applicable). Utility, electrical rooms, etc. that do not require a ceiling, will be provided with chain-hung, linear LED industrial type fixtures.

All new interior and exterior light fixtures shall be energy efficient, LED type (unless specifically noted otherwise on the project) and shall be specific to the project that they will be utilized on. Light fixtures/manufacturers shall be provided as indicated on the projects lighting fixture schedule or an approved equal if allowed by the project Architect or Engineer. For rooms with acoustic ceiling tiles (ACT), the preferred ACT and light fixture sizing is 2' by 2' square.

LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours. LED luminaires shall deliver a minimum of 90 lumens per watt and shall be 'Bin #1' quality. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input with a power factor of 0.9 or higher.

Exit/Egress shall be LED with diffused lens and connected into a multi-volt source with emergency generator backup, if no generator is available the lights shall have a self-contained power pack, charger and transfer relays.

Lighting Control:

Lighting controls shall be provided to meet the requirements of the most current International Energy Conservation Code "IECC". At minimum vacancy/occupancy sensors with manual control shall be provided in all areas of the project unless the area meets the exceptions of the IECC. Occupancy/vacancy sensors will be provided with low voltage control and will be of the passive infrared, ultrasonic, or dual technology type where applicable.

Typical single gang toilet rooms, private offices, storage rooms, rooms that are no larger than 20'x20' shall be provided with a stand-alone, in-wall Passive Infrared Red "PIR" vacancy/occupancy sensors with adjustable timeout located on the closure side of the door (not blocked when door is open) with a clear view of the room.

Larger conference rooms, classrooms, laboratories, room sizes in excess of 20'x20' shall be equipped with a ceiling mounted dual technology sensor PIR and Ultrasonic (number and locations of sensors are job specific) with a separate wall switch. The sensor and wall switch shall be wired so that when the switch is in the 'on' position and sensor detects an individual and the lights go on, if the switch is not turned off when no one is in the room the lights turn off via the adjustable sensor timeout. The lights can always be turned off manually with the switch control.

Where sensors are not required by code "IECC" the code typically requires 50% light reduction which will accomplished via a 0-10V wall mounted dimming switch with a 0-10V dimmable driver that is standard in a majority of the LED light fixtures.

All building mounted exterior lighting and associated parking lot site lighting (if applicable) shall be controlled via the proposed building-wide lighting control relay panel containing a time clock and photocell to give the owner the diversity in controlling the exterior lights.

If remote occupancy sensors will be used to control space temperature, hardwire the sensors to the local unit controllers.

Exterior Lighting Fixtures

The following light fixtures are currently used for new lighting projects on campus. Contact LU Facilities to confirm which of the lights listed below to be used on the project based on campus setting and to obtain additional design parameters, including existing electrical service information. Substitutions/Alternatives may be suggested but require written approval from LU Facilities representative.

A. LED Victorian Style Fixture: Penn GlobeNewport 1000 Luminaire with Boston Fluted Post or equivalent Hadco fixture and post described in C1360-DWG05
B. LED Roadway and Parking Lot Fixture: Kim Lighting Altitude
C. LED Roadway for Wooden Poles: Patriot (PT-MRL01)
D. LED Residential Fixture: Beacon Lighting La Jolla

Fire Alarm:

Refer to Life Safety section on Facilities website for a complete life safety fire alarm standard.

Campus fire alarm system/devices shall be EST (Edwards) manufacturer, and all work shall be coordinated through the local vendor:

Eastern Time
P.O. Box 4425
Allentown, PA 18106
Contact: Bryan Rizzo
Phone: (610) 776-1222.
Email: bryanr@eastern-time.com

Telecommunication:

All telecommunication wiring, equipment, devices, installation, etc. shall be provided per the Lehigh University Telecommunication Standard Specification.