

DESIGN GUIDELINES

Facilities Services, Campus Planning and Projects Department



LEHIGH
UNIVERSITY®

November 11, 2016

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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

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<i>Consulting Firm Name</i>	<i>November 11, 2016 = LU Design Guideline Issue Date</i>	
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<i>Consulting Firm Principal</i>	<i>Signature</i>	<i>Date</i>

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. Designs must be reviewed and approved by FM Global (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.

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 4" and smaller shall be hard copper tube, 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.

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.

Trap seal primers shall be furnished on all floor drains.

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 hubless cast iron pipe and fittings, heavy duty shielded, stainless steel couplings; and hubless-coupling joints.

Sanitary and Waste Vent Piping:

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

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 shall be steel pipe with malleable-iron fitting and threaded joints or may be steel pipe with wrought-steel fittings and welded joints. Apply protective coating over piping to cover, seal, and protect piping and joints.

Plumbing Fixtures:

Water closets shall be a white vitreous china, wall mounted fixture as manufactured by Kohler, Toto, or American Standard. Manual flush valves as manufactured by Sloan Model 111. Mount fixtures at ADA height where required. Provide with molded, solid plastic, open front seat without cover.

Urinal shall be a white vitreous china, wall mounted fixture as manufactured by Kohler, Toto, or American Standard. Manual flush valves as manufactured by Sloan model 180. Mount fixtures at ADA height as indicated.

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 manual faucet. Faucet shall be Chicago Faucet, Model 420-CP Mount fixtures at ADA height as indicated.

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.

Mop receptors shall be floor mounted, molded stone with integral drain molded into one piece unit. Provide with chrome plated service faucet with vacuum breaker, integral stops, adjustable wall brace, pail hook, mop hangers, 3/4' hose thread on spout, and stainless steel wall guards. Mop receptor shall be by Fiat, Model MSB.

Electrical water coolers shall be bi-level, one ADA and one standard height. Coolers shall be refrigerated to generate 7.5 gph, 80F inlet and 50 F outlet water. Water coolers shall be Halsey Taylor.

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.

DIVISION 23 – HVAC

Design Conditions:

Interior design temperatures:

Summer: 74 deg. F. Winter: 72 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 April 15th thru November 15th.

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.

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 and shall capable of total mass consumption in lbs./hr. with pressure/temperature compensation. The Veris meter uses a 4-20mA signal for steam flow

and a pulse for every 1000 lbs. of steam. Meters must communicate via Modbus or BACNet to direct digital control (DDC) via Ethernet connection. RTD (resistance temperature detector) shall be included to extract all steam data. 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.

All high performance butterfly valves shall be limited to Cooper Cameron, WKM DynaCentric, or Crane Co.

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 manufacturers 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".

Testing, Adjusting, and Balancing for HVAC:

On all renovation projects, it is highly recommended 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.

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 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 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 1 ½".

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 1 ½".

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.

Thermostats must restrict settings to 70 deg. F. to 76 deg. F.

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.

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

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. 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. The use of grooved mechanical fittings and couplings shall be limited to Victaulic, and shall be used on chilled-water systems only, 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.

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, Aurora Pumps, 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.

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 shall be limited to the Tunstall Corporation. In the Drinker-Dravo and Richards buildings, Spirax-Sarco float & thermostatic shall be specified.

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 sheetmetal 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 3/4" 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.

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. is the preferred manufacturer for all chillers. Carrier, York, or Daikin-McQuay 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.

"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.

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 13 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 windows that will have year round load.

Variable Frequency Drives:

ABB model ACH550 is the only acceptable manufacturer and shall be specified with an integral disconnect switch. Any motor 50 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. 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 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. 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 the contract drawings. Transformers shall be furnished with two (2) 2-1/2% taps above and four (4) 2-1/2% taps below rated voltage.

Raceways:

Conduits:

Minimum conduit size shall be 3/4" 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.

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 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 via the associated building DDC system. Generators shall be natural gas type based on the physical location on the Campus. All generator locations must be coordinated and approved by Lehigh University. Certain areas of the 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.

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) unless otherwise noted on the design drawings. Transfer switches shall be tied into the buildings DDC system to provide transfer switch status "Normal or Emergency mode" from a remote location.

Building Electric Metering:

A multi-function meter shall be provided on the electrical service to the building. The meter manufacturer shall be Shark200 model 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 to provide the ability to monitor the multi-function meter from a remote location.

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:

Provide an Arc Flash Hazard Study for the electrical distribution system shown on the single-line of design drawings to be performed 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 one line drawing. This includes switchgear, switchboards, panelboards, motor control centers, paralleling gear, and transformers. The proposal shall state the total number of arc flash labels (locations with calculations) that will be supplied. The study will include creation of Arc Flash Hazard Warning Labels listing all items as shown on the sample label below. These 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.

Fault Coordination Study:

A complete coordination study for system protection to 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 to 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.

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 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.

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 60 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.

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, 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 be 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.

Fire Alarm:

Campus fire alarm system/devices shall be EST (Edwards) manufacturer 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.