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CHAPTER 1—UTILITY METERING SPECIFICATIONS

Section 1.1 Location of Meters

1.1.1 The Engineer shall provide manufacturers required service and maintenance access space for building energy meters and associated devices at locations approved by KSU Energy Program.

1.1.2 Building energy meters shall be installed on interior of building (i.e. Mechanical Room), near utility-service entrance. In the case of Utility Company provided meter installation, where meters are utilized for billing purposes, the meters shall be installed exterior to the building or per utility company requirements, with pathway as required for communication wiring to enter mechanical room.

Section 1.2 Electric Meters

1.2.1 Action Submittals

1.2.1.1 Wiring Diagrams: For power signal and control wiring, identify terminals, wiring descriptions and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.

1.2.2 Quality Assurance

1.2.2.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.2.3 Products

1.2.3.1 Kilowatt-hour/Demand Meter: Electronic three-phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.

1.2.3.1.1 Voltage and Phase Configuration: Meter shall be designed for use on both 3-phase 3-wire delta and 3-phase 4-wire wye circuits with voltage rating and phase configuration indicated for its application.

1.2.3.1.2 Display: 4-line by 20-character backlit LCD, indicating accumulative kilowatt-hours, current time and date, current demand, and time and date of historic peak demand.

1.2.3.1.3 Memory: Shall retain 2 channels of accumulated kilowatt-hour and historic peak demand in a nonvolatile memory, until reset. 36 days of accumulated data shall be stored in 15 intervals.

1.2.3.1.4 Meter shall have a 3rd channel for an external pulse input for use in totalization of other utility usage (water, gas, etc.).

1.2.3.2 General Requirements for Owner’s Meters

1.2.3.2.1 Enclosure: Industrial Grade JIC, with hasp for padlocking or sealing. Option for weatherproof enclosure.
1.2.3.2.2 Sensors: Current-sensing type, with voltage output 0-2V, selected for optimum range and accuracy for meters indicated for this application. Sensors shall allow for remote mounting up to 500 feet from meter without loss of power.

1.2.3.2.2.1 Type: Split Core

1.2.3.2.3 Building Automation System (BAS) Interface: Match signal to Honeywell input and arrange to convey the instantaneous, integrated, demand and usage level measured by meter to provide data for processing and programmed analysis by designation system.

1.2.3.2.4 Relays/Alarms: Optional load control/alarm relay with high and low threshold adjustment.

1.2.3.2.5 Installation diagnostics and verification system.

1.2.3.2.6 Approvals: Shall be UL and CSA listed. Shall comply with ANSI C12.1 and C12.16.

1.2.3.3 Communications Options

1.2.3.3.1 Modbus RTU or TCP/IP

1.2.3.3.2 LONworks TP (twisted pair)

1.2.3.4 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1.2.3.4.2 Emon Demon

1.2.3.4.3 Approved Equal, as determined by KSU Energy Dept.
Section 1.3 Flow Meters: Domestic Water Meters, Steam Meters, Natural Gas Meters

1.3.1 Action Submittals

1.3.1.1 General - Submit the following:

1.3.1.1.1 Product data for each type of meter. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter schedule showing manufacturer’s figure number, scale range, location, and accessories for each meter and gauge.

1.3.1.1.2 Product certificates signed by manufacturers of meters certifying accuracy under specified operating conditions and products’ compliance with specified requirements.

1.3.1.1.3 Include flow straighteners for instances or locations where pipe-diameter-clearance cannot be achieved for turbulence issues.

1.3.1.1.4 Maintenance data for each type of meter for inclusion in Operating and Maintenance Manuals for project.

1.3.2 Quality Assurance

1.3.2.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
Section 1.4 Domestic Water Meters

1.4.1 Positive Displacement Flow Meter

1.4.1.1 Flow meter shall be non-magnetic, with forward curved impeller blades designed for water containing debris. Materials which will be wetted shall be made from non-corrosive materials and shall not contaminate water.

1.4.1.2 Equip each flow meter with a metal identification tag indicating the size, location, GPM and meter reading for the GPM specified.

1.4.1.3 Sensor accuracy shall be plus or minus 1.5% of reading over the full range of flow, minimum operating flow velocity shall be ~1 foot per second. Sensor repeatability and linearity shall be plus or minus 1%. Materials which will be wetted shall be made from non-corrosive materials and shall not contaminate water.

1.4.1.4 The flow meter shall be provided with particulate strainer, isolation valves and bypass line to be rated for installation in pipes of 3/4 to 10 inch diameters.

1.4.1.5 A pulse transmitter shall provide a pulse output that is scalable to gallons per pulse (not to exceed 10 Gallons per pulse) and clearly defined in supporting documentation. The pulse transmitter housing shall be NEMA 1, NEMA 3R or NEMA 4.

1.4.1.6 Manufacturers: Subject to compliance with requirements, provide products by one of the following, with registration in gallons:

1.4.1.6.1 Badger

1.4.1.6.2 Elster, AMCO

1.4.1.6.3 Neptune Water Meter Co.

1.4.1.6.4 Approved Equal, as determined by KSU Energy Dept.
Section 1.5 Saturated Steam Meters

1.5.1 Turbine Mass Flow Meter

1.5.1.1 Calibration: Factory programmed application specific

1.5.1.2 Accuracy: Plus or Minus 1 percent of reading for volumetric flow and plus or minus 2 percent for mass flow over the entire operating range.

1.5.1.3 Sensing Method: Turbine rotor with electromagnetic pick-up.

1.5.1.4 Operating Range: -40 degrees F to 140 degrees F ambient, -40 degrees F to 750 degrees F medium. Maximum 300 PSI operating pressure.

1.5.1.5 Material: 316L stainless steel body with epoxy painted aluminum or cast aluminum electronics enclosure.

1.5.1.6 Output Signal: 4 to 20 mA or 14 to 36 VDC for mass flow rate, scaled pulse output for total flow.

1.5.1.7 Display: 2 line alphanumeric LCD

1.5.1.8 Power: 14 to 36 MDC, 20 mA maximum

1.5.1.9 Pipe Connections: ANSI Class 150, 300, or 600 Flange as required by application.

1.5.1.10 Provide all components required to calculate mass flow.

1.5.1.11 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1.5.1.11.1 Spirax-Sarco: EMCO

1.5.1.11.2 Onicon

1.5.1.11.3 Approved Equal, as determined by KSU Energy Dept.

1.5.2 Vortex Shedding Mass Flow Meter

1.5.2.1 Calibration: Factory programmed application specific

1.5.2.2 Accuracy: Plus or Minus 1 percent of reading for volumetric flow and plus or minus 1.5 percent for mass flow over the entire operating range.

1.5.2.3 Sensing Method: Vortex shedding with integral piezoelectric sensors and integral 1000 ohm platinum RTD.

1.5.2.4 Operating Range: -40 degrees F to 140 degrees F ambient, -40 degrees F to 450 degrees F medium. Maximum 300 PSI operating pressure.

1.5.2.5 Material: 316L or 304 stainless steel body with epoxy painted aluminum or cast aluminum electronics enclosure.
1.5.2.6 Output Signal: 4 to 20 mA or 14 to 36 VDC for mass flow rate, scaled pulse output for total flow.

1.5.2.7 Display: 2 line alphanumeric LCD

1.5.2.8 Power: 14 to 36 MDC, 20 mA maximum

1.5.2.9 Pipe Connections: ANSI Class 150, 300, or 600 Flange as required by application.

1.5.2.10 Provide all components required to calculate mass flow.

1.5.2.11 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1.5.2.11.1 Spirax-Sarco: EMCO

1.5.2.11.2 Onicon

1.5.2.11.3 Approved Equal, as determined by KSU Energy Dept.

Section 1.6 Saturated Steam Meters

1.6.1 Strain Gauge Mass Flow Meter

1.6.1.1 Calibration: Factory programmed application specific.

1.6.1.2 Accuracy: Plus or Minus 1 percent of reading for volumetric flow and plus or minus 1.5 percent for mass flow over the entire operating range.

1.6.1.3 Sensing Method: Strain Gauge

1.6.1.4 Operating Range: -40 degrees F to 140 degrees F ambient, -65 degrees F to 425 degrees medium. Maximum 300 PSI operating pressure.

1.6.1.5 Material: 316L or 304 stainless steel body with epoxy painted aluminum or cast aluminum electronics enclosure.

1.6.1.6 Output Signal: 4 to 20 mA or 14 to 36 VDC for mass flow rate, scaled pulse output for total flow.

1.6.1.7 Display: 2 line alphanumeric LCD

1.6.1.8 Power: 14 to 36 MDC, 20 mA maximum

1.6.1.9 Pipe Connections: ANSI Class 150, 300, or 600 Flange as required by application.

1.6.1.10 Provide all components required to calculate mass flow.
1.6.1.11 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1.6.1.11.1 Aaliant

1.6.1.11.2 Approved Equal, as determined by KSU Energy Dept.

Section 1.7 Natural Gas Meters

1.7.1 Mass Flow Meter

1.7.1.1 Equip each flow meter with a metal identification tag indicating the size, and location.

1.7.1.2 Sensor accuracy shall be plus or minus 0.5% of full scale or plus or minus 1% or reading. Sensor repeatability shall be plus or minus 0.2%. Materials which will be wetted shall be made from non-corrosive materials.

1.7.1.3 The mass flow meter shall be provided with isolation valves and shall be rated for installation in pipes of 1/4 to 36 inch diameters.

1.7.1.4 The transmitter shall provide a 4 to 20 mA dc pulse output linearly proportional to flow. The pulse transmitter housing shall be NEMA 1, NEMA 3R, or NEMA 4.

1.7.1.5 Manufacturers: Subject to compliance with requirements, provide products by one of the following, with registration in MCF:

1.7.1.5.1 Sage

1.7.1.5.2 Kurz

1.7.1.5.3 Eldridge

1.7.1.5.4 Approved Equal, as determined by KSU Energy Dept.
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Section 2.1 Site Evaluations

2.1.1 Subsurface Investigation

2.1.1.1 Coordinate all subsurface investigation site access with Abe Fattaey, University Engineer; or Gary Kilner, Surveyor; in the Division of Facilities Planning at (785) 532-6377 to locate all underground utilities before beginning subsurface investigation.

2.1.1.2 All utilities need to be located by the Planning Office 48 hours in advance of start of work.

2.1.2 Soil Borings

2.1.2.1 Most soil borings shall be located, to the extent possible, near the location of proposed footings.

2.1.2.2 For each new building or addition, there shall be at least one boring for every 2,000 square feet of building footprint, with a minimum of four soil borings, or as recommended by the geotechnical engineer.

2.1.2.3 Immediately after completion of soil borings each location is to be backfilled, cleaned up, have all holes plugged/filled and sod, asphalt or concrete restored to original condition.

Section 2.2 Excavation and Backfill

2.2.1 Rock excavation

2.2.1.1 All contract documents that include any excavation work involving rock shall include a specific amount of each kind of rock excavation in the base bid of the contract. Any requirement for over excavation of rock surfaces is to be clearly stated in the bid documents.

2.2.1.2 A unit price shall be required for each kind of rock excavation that shall be used to adjust the base bid, for either more or less rock excavation than the amount included in the base bid.

2.2.1.3 At a minimum, rock excavation shall be divided into two categories: trench and general. A specific definition shall be included in the specifications for each type of rock excavation.

2.2.1.4 No explosives are to be used for rock excavation on the main campus, within the city limits of the City of Manhattan, without specific written owner approval.

2.2.2 Spread and pad footings

2.2.2.1 The bearing soil shall be placed in 6" lifts and compacted to a minimum of 95% of maximum density at optimum moisture content (± 2%), standard proctor, or as recommended by the geotechnical engineer. Excavation to undisturbed soil is not considered adequate.
2.2.2 Immediately prior to installation of reinforcing steel and placement of concrete, the soil shall be inspected by the geotechnical engineer. The inspecting agency will be retained by the Owner, but the inspections shall be scheduled by the contractor.

2.2.3 Piles and Piers

2.2.3.1 Auger Cast Piles – To be used only in certain areas of campus, generally bounded along the east and south edges of the main campus: from Justin Hall to Beach Museum, to Memorial Stadium.

2.2.3.1.1 Description: Furnish and install augered pressure grouted intrusion piles as required. The extent of piles is to be shown on the drawings, including locations, diameters of shafts (straight and battered), estimated bottom elevations, top elevations, and details of construction.

2.2.3.1.2 Quality Assurance

2.2.3.1.2.1 Codes and Standards: Perform pier work in compliance with the building code, including provisions for adequate protections to persons and property.

2.2.3.1.2.2 Contractor Qualification: Contractor shall have a minimum of five years experience in work of a nature and scope similar to that required by this section.

2.2.3.1.3 Job Conditions

2.2.3.1.3.1 Soils Report: The Owner will contract with a geotechnical engineer to provide a detailed soils report for the design team and contractors’ use. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by the Architect and Contractor. The data are made available solely for the convenience of the Architect and Contractor.

2.2.3.1.3.2 Additional Information: Additional test borings and other exploratory operations may be made by the Contractor, as he deems necessary, and at no cost to the Owner.

2.2.3.2 Products

2.2.3.2.1 Materials

2.2.3.2.1.1 Portland Cement: ASTM C150, Type I or Type II

2.2.3.2.1.2 Special Pozzolan: When available, provide an approved fly ash or other finely powdered siliceous material capable of combining with the lime liberated during the hydration of portland cement.

2.2.3.2.1.3 Grouting Agent: An approved admixture that affects the cement base mortar to reduce mixing water, retard setting time, decrease bleeding and segregation, and eliminate setting shrinkage.
2.2.3.2.1.4 Water: Fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.

2.2.3.2.1.5 Fine Aggregate:

2.2.3.2.1.5.1 Sand conforming to the requirements of ASTM C33 except that gradation shall be as specified below.

2.2.3.2.1.5.2 Provide hard, dense, durable, uncoated rock particles, free from injurious amounts of silt, loam, lumps, soft or flaky particles, shale, alkali, organic matter, mica, and other deleterious substances. If washed, the washing method shall be such as will not remove desirable fines, and the sand shall subsequently be permitted to drain until the residual-free moisture is reasonably uniform and stable.

2.2.3.2.1.5.3 Sand shall be well graded from fine to coarse, with fineness modulus between 1.40 and 3.40. Fineness modulus is defined as the total divided by 100 of the cumulative percentages retained on U.S. Standard Sieve Nos. 16, 30, 50 and 100.

2.2.3.2.1.6 Piles: Piles shall be of a diameter recommended by the geotechnical or structural engineer, extending at least two feet into the underlying shale bedrock, reinforced as shown on the drawings, and capable of sustaining the minimum allowable working load to achieve the design loading.

2.2.3.2 Mixes

2.2.3.2.1 Provide cement-based, non-shrink grout consisting of portland cement, special pozzolan, grouting agent, sand, and water so proportioned and mixed as to produce a grout capable of maintaining the solids in suspension without appreciable water gain, and which may be pumped without difficulty, and will penetrate and fill any voids in the adjacent soils.

2.2.3.2.2 Hardened grout shall have an ultimate compressive strength of 4,000 psi at 28 days.

2.2.3.2.3 Submit proposed grout mix design to Architect for approval at least fifteen days before beginning work.

2.2.3 Execution

2.2.3.3.1 Examine areas and conditions under which piles are to be installed. Notify Contractor in writing of conditions detrimental to the proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

2.2.3.4 Installation

2.2.3.4.1 Tolerances: Install piles within a tolerance of 3” or less from locations shown on drawings.
2.2.3.4.2 Log: Maintain accurate record of piles installed showing location, date placed, length of pile, and final tip elevation. Submit three copies of pile log to Architect weekly.

2.2.3.4.3 Obstructions: Should obstructions be encountered which would prevent installation of pile to required depth, stop work on that pile group until corrective methods are provided by the Architect.

2.2.3.4.4 Pile Installation:

2.2.3.4.4.1 Install piles using a continuous flight, hollow shaft auger, drilled to the required depth.

2.2.3.4.4.2 Use only approved pumping equipment in preparing and handling grout. Locate a pressure gauge in good operating condition on the grout pump so that the grouting pressure can be checked continuously by the operator and the Architect. Measure all materials by volume or weight as they are fed into the mixer.

2.2.3.4.4.3 Leave auger in hole and inject grout mix under pressure through the hollow shaft of the auger. Slowly withdraw auger. Use earth or gravel fill surrounding auger to retain shape of hole and prevent grout under pressure from escaping along the sides of the auger. Do not raise auger and spin off earth prior to grouting. Earth fill, at least 10 feet deep, shall remain on auger before grouting operation begins.

2.2.3.4.4.4 Place grout continuously without interruption and in a smooth flow without segregating the mixed materials. Consolidate grout with mechanical vibrating equipment.

2.2.3.4.4.5 Grout piles to an elevation of at least one foot above bottoms of pile cap or grade beam. Cut top of pile accurately to final elevation following placement of reinforcing steel, and when grout has stiffened enough to allow cutting of grout without spalling.

2.2.3.4.4.6 At installer's option, pressure grout piles to approximately 6" above pile cut-off elevation and dip out fresh grout to the cut-off elevation prior to initial set.

2.2.3.4.4.7 Do not permit lateral pressure of soil to reduce pile diameter. Avoid sudden withdrawal of auger to prevent collapse of hole or reduction of pile diameter. Doubt on the part of either the Architect or the Contractor that a pile is continuous and of uniform diameter shall be sufficient cause to require that the grout be reamed out and the pile re-grouted.

2.2.3.4.4.8 Take necessary precautions to prevent mud, frozen material or other debris from falling into uncured grout.

2.2.3.4.4.9 Any concentrated loads from equipment must be distributed to prevent compressing or shearing soil in the top area of the pile. Keep concentrated loads at least 10 feet from pile until initial grout set has occurred.

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2.2.3.5 Field Quality Control Testing

2.2.3.5.1 During the progress of the work, make standard 2” x 2” x 2” test cube samples for determining compressive strength of grout injected into the auger borings.

2.2.3.5.2 Furnish molds, make, cure, and store cubes in accordance with ASTM C109. Deliver samples to the testing laboratory. Furnish testing laboratory with information of the location, mix, admixtures, etc. of the batch from which each set of test cubes was taken. Provide a minimum of three pairs of cubes (six cubes) for each day's work. When special pozzolan is used, provide fourth pair. Make each pair of cubes a minimum of three hours apart in the course of the work. Carefully identify samples and record the location of piles from which each sample of grout was taken.

2.2.3.5.3 From each set of six sample cubes, perform tests as follows:

2.2.3.5.3.1 For greater pile length than indicated on the drawings, per linear foot;

2.2.3.5.3.2 For lesser pile length than indicated on the drawings, per linear foot;

2.2.3.5.3.3 For added or subtracted piles of length indicated on the drawings, each.

2.2.3.6 Backfill

2.2.3.6.1 Typical Backfill Materials

2.2.3.6.1.1 Backfill around foundations shall be installed in no more than 12” lifts. Specific situations or soils may require smaller lifts, at direction of geotechnical engineer.

2.2.3.6.1.2 Using a standard proctor at optimum moisture content (+2%), all backfill shall be mechanically compacted to a minimum of 88% and a maximum of 92% of maximum density under landscape areas and minimum of 95% of maximum density under other areas.

2.2.3.6.1.3 The backfill shall be inspected and tested at the discretion of the owner's representative and the geotechnical engineer. The owner shall retain the services of an engineering inspection and testing firm. The contractor shall be responsible for coordinating and scheduling the inspections.

2.2.3.6.1.4 The use of fly ash and/or lime as an additive shall be considered on a case-by-case basis.

2.2.3.6.2 Alternate Backfill Material
2.2.3.6.2.1 Flowable Fill, such as that provided by MidWest Concrete, can be considered for use for subgrade and in trenches backfilling utilities.

Section 2.3 Concrete

2.3.1 All concrete used in footings, foundations, slabs or sidewalks shall have a minimum strength of 4,000 psi. All concrete used in exterior, exposed to the weather type applications shall be air-entrained concrete.

2.3.2 Calcium chloride shall not be used in any concrete. A noncalcium accelerator may be considered for use in concrete.

2.3.3 Masonry units shall not be used for foundation walls below grade.

Section 2.4 Reinforcement

2.4.1 Reinforcing steel and accessories shall conform to CRSI Standards and shall not be placed in contact with soil. Reinforcing steel shall not extend to the surface of the concrete. Chairs shall be used on all horizontal concrete surfaces, either formed or on grade. Chairs and other accessories shall be metal. Use of Fiber Mesh in lieu of reinforcing steel is not allowed.

2.4.2 Reinforcing systems may be required to be engineered.

Section 2.5 Penetrations

2.5.1 General guidelines

2.5.1.1 All penetrations of foundation walls shall be leak-proofed. Where required they shall be fire resistant.

2.5.1.2 All penetrations, except steam tunnels, shall be individual pipes or conduits. Groups of pipes or conduits in a common penetration shall not be allowed.

2.5.1.3 In instances where reinforcing steel is used to attach another mass of existing concrete to the foundation walls (duct banks, steam tunnels, etc.), the steel pins shall be attached to the foundation walls through the use of epoxy capsules similar to those supplied by Hilti.

2.5.1.4 Minimum clearances shall be 3” clearances between pipes or sleeves.

2.5.1.5 The conduit shall penetrate the foundation in the following manner:

2.5.1.5.1 For new construction, the foundation wall shall have a steel sleeve installed that is 2” larger in diameter than the conduit to be installed. For existing construction, the hole shall be core drilled. In multiple duct situations, sufficient space shall remain between the penetrations to maintain the structural integrity of the foundation wall.

2.5.1.5.2 A rubber seal, equal to link-seal, shall be installed in the space between the conduit and the sleeve or drilled hole, near the interior surface of the foundation wall. The same space shall have waterproofing installed on the exterior side of the rubber seal.

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2.5.2 Electrical duct banks

2.5.2.1 Concrete encased duct banks shall terminate at the exterior surface of the foundation wall. The conduit shall make individual penetrations of the foundation wall.

2.5.2.2 All duct banks shall be attached to the foundation wall in one of two manners. In new construction, the reinforcing steel of the foundation wall may be extended into the concrete encasement of the duct bank at the time of placement. Alternately, reinforcing steel may be drilled into the foundation wall and extended into the duct bank concrete. The steel that is inserted into the foundation wall shall be attached through the use of epoxy capsules, similar to those supplied by Hilti.

2.5.2.3 All duct bank conduits within the limits of the project site of the foundation wall penetration shall be rigid steel conduit. The conduit shall be installed with a sloped grade down and away from the building.

2.5.3 Steam and condensate

2.5.3.1 The point of attachment for steam tunnels shall have a concrete, cast-in-place transition, with waterstopping material cast into the concrete. The waterstopping shall be embedded into the foundation wall according to the manufacturer’s recommendations. Waterstopping material shall be equal to Volclay RX-102.

2.5.3.2 Individual penetrations of steam and condensate lines shall be installed as follows: The foundation penetration shall be the anchor point. The penetration shall be sleeved with a galvanized steel sleeve.

2.5.4 Other pipe penetrations

2.5.4.1 The minimum strength of pipe penetrating foundation walls shall be equal to schedule 40.

2.5.4.2 All penetrations, except steam, steam condensate, or other high temperature piping, shall be waterproofed in the same manner as described in previous paragraph 2.5.1.5.1.

2.5.5 Other penetrations

2.5.5.1 Penetrations of foundation walls by direct burial cable shall be sleeved or core drilled, and shall be sealed through the use of 3M Scotchcase 2114, or equal sealant. Direct burial of cable is described in Chapter 9 of the Specifications: paragraph 9.2.2.

Section 2.6 Drainage Systems

2.6.1 A footing/foundation positive drainage system shall be installed on all buildings with usable space below grade. There are various methods and systems available to provide good foundation drainage. Drainage system recommendations will be provided by geotechnical engineers.

2.6.2 Piping
2.6.2.1 All pipe used in foundation drainage systems shall be a minimum of Schedule 40.

2.6.2.2 Cleanouts shall be installed downstream of each 90-degree elbow, within 12" of the elbow. On straight runs of pipe, cleanouts shall not be located more than 100' apart. All cleanouts shall be supplied with brass plugs.

2.6.2.3 All drainage piping shall be connected as required to storm sewer piping or sump pumps, not sanitary sewer.

2.6.2.4 Filter fabric shall be used.

Section 2.7 Slab On Grade (Interior, Structural)

2.7.1 The bearing soil under slabs on grade shall be compacted to a minimum of 95% of maximum density at optimum moisture content or as recommended by the geotechnical engineer. Excavation to undisturbed soil is not considered adequate. Depth of compaction for slabs on grade to be provided by designer of slab system.

2.7.2 Joints

2.7.2.1 Joint spacing and joint detail shall be shown in the drawings.

2.7.2.2 Expansion joints shall be required with a maximum spacing between joints of 30 feet. Expansion joints shall have dowel bars and shall allow load transfer and slab expansion. Non-extruding expansion joint material shall be used.

2.7.2.3 Control joints shall be cut as soon as the concrete can be walked on without damage to the finish (soft cut). Control joints shall be cut a minimum of 2" deep or to a depth of 25% of the slab thickness; whichever is greater.

2.7.2.4 Slab flatness and levelness shall be within 1/8" in 10'. ASTM E1155 shall not be used to specify flatness and levelness unless the particular use requires a high level of accuracy. Areas that have floor drains shall not be required to meet the levelness tests, but shall have positive slope to the floor drain. The amount and direction of slope for floor drains shall be indicated on the drawings.

2.7.2.5 All slabs on grade shall have a positive drainage system installed. This can be a system of drain piping beneath the slab, with a sump pump, to collect and remove the water beneath the slab or a drainage system which extends direct to grade.

2.7.2.6 Dowel into existing sidewalks, building or other surfaces.

Section 2.8 Crawl Spaces

2.8.1 Crawl spaces should be avoided in favor of basements. However, they shall not have earth floors. The preferred treatment is the placement of concrete on the floor areas.

2.8.2 Crawl spaces shall be ventilated, have a drainage system to prevent standing water, and shall have fluorescent lighting installed as required by the UBC/NEC with switching at each exit door.

2.8.3 Crawl spaces shall be a minimum clearance of five feet to the lowest hanging pipe, beam or ductwork.
Section 2.9 Equipment Pits

2.9.1 Equipment pits shall be drained by gravity.

2.9.2 Where gravity drainage is not possible, a sump with a pump shall be installed. The sump shall have an alarm installed and be connected to the campus security system, to alert maintenance personnel whenever the water level rises and before the water overflows the pit. Where the campus security system is not available, a local alarm shall be installed. In circumstances with a high water table or underground stream install a secondary pump at a higher level for backup in case the first pump were to fail. Verify underground water characteristics prior to design of backup system.

2.9.3 A ladder and fluorescent lighting shall be provided in each equipment pit.

Section 2.10 Thermal and Moisture Protection

2.10.1 Insulation

2.10.1.1 Foundation walls shall be insulated on the exterior surface of the wall from the finish grade, to a minimum of 30" below finish grade. Insulation installed on the exterior of foundation walls shall be attached to the wall. All insulation shall comply with ASHRAE 90.1.

2.10.1.2 Foundation walls associated with a slab on grade that is above the surrounding grade shall be insulated in the interior of the foundation wall surrounding the bottom of the slab to a minimum of 30" below the exterior grade.

2.10.2 Waterproofing

2.10.2.1 All foundation walls shall be waterproofed below grade.

2.10.2.2 All foundation drains are to be installed according to Section 2.6, Drainage Systems.

Section 2.11 Cleaning Procedures

2.11.1 Cleaning services to be provided:

2.11.1.1 Daily: Contractor to power wash streets and sidewalks after contractor vehicles have left tracks on the way to or from the project site. Spud hoe up clods of dirt thrown from or crushed by tires, etc. and remove from site. Street sweep access routes used by contractors to edge of campus as well as provide follow up cleaning – broom and wash.

2.11.1.2 Weekly: Contractor to remove stains from paved surfaces caused by rubber from tire tracks, oils, fuels, solvents, etc.

2.11.1.3 Daily: Contractor to pick up litter within project site and any litter within 50 feet of the university’s side of the project site fence, along access routes, contractor storage yards and parking area. Debris to be placed in contractor’s trash containers. Contractor is responsible for removal of all construction debris.
2.11.1.4 Weekly: keep weeds and grasses in control every 5 days within project site along and either side of project fence and in contractor parking/storage yards (use weed eater for cutting).

2.11.2 Contractor Specifications

2.11.2.1 The campus is a pedestrian campus and must remain accessible for the safe movement of pedestrians through the entire campus.

2.11.2.2 Contractor shall provide alternate or temporary sidewalks to keep people moving, with adequate all-weather surfaces for safety.

2.11.2.3 Contractor to use boring methods to pass utility lines under and keep all paved areas intact to the greatest extent possible.

2.11.2.4 Contractor must share sidewalks and streets with pedestrians and other service vehicles along their access route to their project site boundaries.

2.11.2.5 Alternative traffic methods need to comply with all applicable codes and regulations.

2.11.2.6 ADA accessibility for personnel and vehicles must be maintained.

2.11.2.7 Required fire exit paths from building must be maintained with a hard all-weather surface and never be blocked by contractor equipment, materials or work at any time during the workday.

2.11.2.8 Access to site for university personnel or other contractors must be maintained at all times.

2.11.2.9 Contractor may use sidewalks/streets for limited access to site, provided:

2.11.2.9.1 When the ground is moist, planking is required along the path of access to prevent construction vehicle damage to grounds.

2.11.2.9.2 Contractor personnel shall direct pedestrian traffic for safety purposes adjacent to project site when heavy equipment needs access to and from project site across sidewalks/streets.

2.11.2.10 Contractor is to use planking, or other protective measures.

2.11.2.11 Contractor is to either clean concrete trucks within the project site or do it off campus property.
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CHAPTER 3—SUPERSTRUCTURE SYSTEMS

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CHAPTER 3—SUPERSTRUCTURE SYSTEMS

Section 3.1 General Requirements

3.1.1 Dead and live loads for all structural systems shall be noted on the drawings.

3.1.2 If the AISC “Code of Standard Practice for Steel Buildings and Bridges” is used or referenced, the specifications shall modify that code by the deletion of the following sentence in paragraph 4.2.1: “This approval constitutes the owner’s acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as a part of his preparation of these shop drawings.” The owner does not accept any responsibility for design adequacy.

3.1.3 New structural systems shall not be structurally connected to existing structures, except when the new structures are constructed above the existing structure. Additions to existing structures shall be separate from the existing structure with an expansion joint at the point of attachment. This is to prevent the problems created by settlement of new structures as compared to relative stability of the existing structure. It also takes into account the earthquake zone conditions outlined by the UBC for this area of Kansas.

Section 3.2 Cast in Place Concrete

3.2.1 General requirements

3.2.1.1 At expansion joint locations, the structure on each side of the expansion joint shall have full structural support.

3.2.1.2 Exposed concrete shall be free of imperfections caused by the forms.

3.2.2 Testing

3.2.2.1 The concrete shall be tested for strength, air entrainment, temperature, and slump. The specifications shall indicate allowable limits for each.

3.2.2.2 The university will retain the services of a testing firm. The contractor shall be responsible for scheduling the tests. The contractor shall be required to notify the owner’s representative a minimum of 48 hours prior to all placement of concrete.

3.2.2.3 Concrete shall be tested at the minimum rate of one test for the first 25 CY. placed each day, and one test for each additional 50 CY. placed. The concrete may be tested more often at the discretion of the owner’s representative.

3.2.2.4 The specifications shall make it clear to the contractor that quality control is the responsibility of the contractor. The above testing in no way relieves the contractor of the responsibility to comply with the specifications.

3.2.3 Calcium chloride shall not be permitted.

3.2.4 Slab flatness and levelness shall be within 1/8” in 10’. ASTM E1155 shall not be used to specify flatness and levelness unless the particular use requires a high level of accuracy. Areas that have floor drains shall not be required to meet the levelness tests, but shall have positive slope to the floor drain. The amount and direction of slope for floor drains shall be indicated on the drawings.
Section 3.3 Steel Structures

3.3.1 The specifications shall clearly state the responsibility for the design of steel connections. The responsibility may lie with the project designer or with the steel supplier. The responsible party must seal the connection designs.

3.3.2 Testing: The owner will retain the services of an independent testing agency to test all steel connections. Early in the design phase, the A/E shall estimate the cost of steel testing. The contractor shall be responsible for the cost of retesting any steel connections that fail any tests. The contractor shall be required to provide a minimum of 24 hours notice to the owner's representative prior to the time testing will be needed.

Section 3.4 Roof Structures

3.4.1 Gypsum decking shall not be used. The preferred decking material is steel or lightweight concrete.

3.4.2 All roof decks shall be designed with a minimum slope of 1/4" per foot. Positive slope for drainage shall be provided by the roof deck rather than tapered insulation.
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CHAPTER 4---EXTERIOR CLOSURE

Section 4.1 General Requirements

4.1.1 The exterior closure of all buildings shall comply with ASHRAE 90.1.

Section 4.2 Wall Types

4.2.1 General information

4.2.1.1 The exterior wall material of choice for all university facilities is bottom ledge "Cottonwood" limestone. Some existing buildings have been constructed with a mix of "Cottonwood" limestone along the ground and "Neeva" limestone in the upper areas of the buildings. "Cottonwood" bottom ledge is a denser stone and withstands weathering better than "Neeva." There are color differences between the two.

4.2.1.1.1 Kansas limestone will be specified for all projects that involve an addition to one of our existing limestone buildings. The bid specifications can include as an alternate the use of other (non-Kansas) limestone for new freestanding buildings to be constructed on the Manhattan campus. However, a decision to accept such material as an alternate would require a careful comparison of that material with the color, texture and overall appearance of the limestone exteriors of surrounding campus buildings.

4.2.1.2 No exterior wall surfaces shall be constructed of wood materials. The possible exceptions to this are areas that need to match existing wood surfaces to provide historical or aesthetic continuity.

4.2.1.3 Waterproofing or water repellent materials shall not be installed on masonry, concrete, or stone surfaces.

4.2.1.4 The use of "Cast stone" or similar man-made products is prohibited.

4.2.1.5 The use of EIFS systems is only allowed under the most unusual of circumstances and locations. Do not assume this product will be allowed on the main campuses or Vet Med.

4.2.2 Masonry/Stone

4.2.2.1 The design and construction guidelines and technical notes of the Brick Institute of America shall be followed for brick construction, and the Masonry Advisory Council for concrete masonry unit construction.

4.2.2.2 All brick shall comply with ASTM C216 and shall have a rating of no "efflorescence" when tested according to ASTM C67. The owner shall retain an independent testing agency that will randomly test brick delivered to the site for compliance with the above.

4.2.2.3 All shelf angles and other metal objects incorporated into masonry walls shall be hot dipped galvanized and shall have stainless steel fasteners.

4.2.2.4 All flashings shall extend a minimum of 1/4" beyond the face of the wall and shall be bent to form a drip edge.

4.2.2.5 Weeps shall be installed above each flashing. The weeps may be tubes installed at 24"
on center, or rope weeps, installed at 16” on center. Other types of weeps may be used if the manufacturer’s recommendations are followed regarding the spacing and installation to ensure adequate drainage.

4.2.2.6 The designer shall evaluate the expected movement for each wall and require adequate expansion joints to accommodate the movement in addition to those required by the Building Code.

4.2.2.7 Wall ties shall be galvanized steel, of a quality equal to Hohmann & Barnard, Inc., DW10 Box Wall Tie.

4.2.2.8 At joints of different types of materials, (brick and stone, brick and cast concrete, etc.) the mortar shall be raked back a sufficient depth to allow the installation of a backer rod and sealant in the joint. The sealant installation details shall comply with the manufacturer's recommendations.

4.2.2.9 Masonry and stone walls shall be installed without mortar dropping in the wall cavity.

4.2.2.10 Coping stones shall be secured with stainless steel anchors and pins and shall have a continuous rubber membrane flashing beneath the stones that extends flush to the surface of the wall, but not past the exterior surface. All head joints of coping stones shall have joint sealant installed rather than mortar or grout.

4.2.3 Concrete

4.2.3.1 Cast-in-place

4.2.3.1.1 Flint and chert shall be limited to 1% maximum, by weight, in all concrete. Lignite shall be limited to 0.07%, by weight of the fine aggregate.

4.2.3.1.2 All exterior concrete shall have a minimum of 6% (±1%) air entrained.

4.2.3.1.3 All accessories that touch the surface of the concrete shall be coated with plastic or epoxy to prevent rust.

4.2.3.1.4 Testing

4.2.3.1.4.1 The concrete shall be tested for strength, air entrainment, temperature, and slump. The specifications shall indicate allowable limits for each.

4.2.3.1.4.2 The university will retain the services of a testing firm. The contractor shall be responsible for scheduling the tests. The contractor shall be required to notify the owner's representative a minimum of 48 hours prior to all placement of concrete.

4.2.3.1.4.3 Concrete shall be tested at the minimum rate of one test for the first 25 CY placed each day, and one test for each additional 50 CY placed. The concrete may be tested more often at the discretion of the owner's representative.
4.2.3.1.4 The specifications shall make it clear to the contractor that quality control is the responsibility of the contractor. The above testing in no way relieves the contractor of the responsibility to comply with the specifications.

4.2.3.1.5 Calcium chloride shall not be permitted.

4.2.3.2 Pre-cast

4.2.3.2.1 Concrete used in pre-cast panels shall comply with cast-in place requirements noted above.

4.2.4 Stucco and Exterior Insulation Finish System (EIFS)

4.2.4.1 No stucco or plaster shall be used.

4.2.4.2 EIFS shall not be used as the primary finish of a building or major renovation, except in the area of the athletic complex, where specific areas of use may be considered.

4.2.5 Glass

4.2.5.1 All glass systems shall be insulated, double pane glass with thermal break frame construction.

4.2.5.2 All framework shall be aluminum. No steel shall be allowed. Refer to 4.3.5.3 for color selection.

Section 4.3 Penetrations

4.3.1 Doors and frames

4.3.1.1 All exterior pedestrian doors and frames shall be metal and comply with ASHRAE 90.1.

4.3.1.2 Stile-type doors and their frames shall be made of aluminum with all welded construction. All wide stile doors shall have a center rail. All material shall have a minimum thickness of 3/16" and shall be reinforced at hardware locations. Stile doors shall be 2" thick with a minimum stile width of 3 1/2". All bottom rails shall be a minimum of 10" in height. All doors shall have a center-locking rail. Kawneer 350 Tuffline should be used as a standard of quality.

4.3.1.3 Low-usage or non-public doors (mechanical areas, etc.) may be steel doors with steel frames. All steel shall be galvanized, shop-primed, and painted with an epoxy or comparable paint. All steel doors and frames shall be of welded construction. Steel doors shall have a top channel cap, secured in place and sealed.

4.3.1.4 Steel doors and frames shall be a minimum of 16 gauge, and shall be reinforced at hardware locations. All steel doors shall be 1 ¾" thick.

4.3.1.5 All pedestrian doors shall have a minimum size of 3’ in width and 7’ in height.

4.3.1.6 It is required that double doors have a fixed, center mullion. The mullions shall be key removable.

4.3.1.7 In all new construction, all public entrances to the building shall be accessible to
persons with disabilities. Exceptions to this must be approved by the owner.

4.3.1.8 In existing structures, a minimum of one entrance shall be accessible to persons with disabilities.

4.3.1.9 In existing structures, any design for construction in the vicinity of an entrance should evaluate the possibility of making that entrance accessible. Whenever it is physically and economically feasible, all entrances should be made accessible.

4.3.1.10 All frames will have reinforcing at hinges and closer.

4.3.1.11 Keyed Removable Mullions - all keyed removable mullions are required to accept Corbin 7 pin lock cylinders. Precision, Detex, or Sargent. All mullions are to be 2” minimum thickness.

4.3.1.12 Entry Doors:

4.3.1.12.1 Entry door aluminum - extra heavy duty use, 1¼” thick aluminum insulated thermal break frame doors with 1” insulated glass. Doors to have 1'-4" bottom rails, 8½” center rails and wide stiles.

4.3.1.12.2 Entry Doors (Hollow Metal) - hollow metal exterior doors to be galvanized and insulated. Painted finish.

4.3.1.12.3 Entry Door Kickplates - all entry doors are required to have kickplates.

4.3.1.13 Entry Frames:

4.3.1.13.1 Entry Door Frames Aluminum - extra heavy duty use, 1¾" x 4½” aluminum thermal break frame with 1” insulated glass sidelights. Sidelights to have 7½” minimum bottom frame.

4.3.1.13.2 Entry Door Frames (Hollow Metal) - exterior hollow metal frames to be galvanized and insulated. Painted finish.

4.3.1.13.3 Entry Door Thresholds - use ADA accessible aluminum threshold.

4.3.2 Door hardware

4.3.2.1 The following door hardware is acceptable. Other proposed equals will be reviewed by the Facilities Planning Office and the Facilities Lock Shop.

4.3.2.1.1 All doors must accept 1 ¼” mortise cylinder or 7 pin rim device of prescribed keyway, keying to be coordinated with the K-State Lock Shop. Key control system will be provided by K-State Lock Shop.

4.3.2.1.2 Mortise Locksets shall be Corbin Russwin ML2000.

4.3.2.1.3 Cylindrical Deadbolts shall be Corbin Russwin DL3000.

4.3.2.1.4 Cylindrical Passage Sets shall be Weiser.

4.3.2.1.5 Exit Devices, Pushpad Rim, Precision 1100 series preferred; Sargent 1100 series, Dorma 9300 series.

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4.3.2.1.6 Exit Devices, Crossbar Rim, shall be Sargent 9800 or Corbin ED6000.

4.3.2.1.7 Exit Devices, Vertical Rod - Sargent 8700, Corbin ED 6400 are allowed. Vertical rod devices are not allowed.

4.3.2.1.8 Exit Device Trim Packs shall be Precision 39LC, Sargent ETJ, Corbin L3 or any comparable to Corbin LWA Mortise trim.

4.3.2.1.9 Door Coordinators shall be DCI 600 Series.

4.3.2.1.10 Weather Stripping and Smoke Seals shall be surface mounted on doorstop and must have ¼" adjustment slots.

4.3.2.1.11 Electric Strikes shall be Hanchett 12 vdc Fail Secure, 7000 Series, 2005 Smart Pack II or Folger Adam with Precision door hardware for fire rated devices.

4.3.2.1.12 Electric Key Switches shall be Locknetics 640 Series, HD Key Switch 643 0404, L2 option.

4.3.2.1.13 Electric Door Holders shall have metal covers.

4.3.2.1.14 Overhead Doors shall accept Corbin 7 pin Rim Cylinders.

4.3.2.1.15 Doors in masonry walls

4.3.2.1.15.1 ½" conduit shall be installed in the wall on the latch side of the door. The conduit shall extend out of the corridor side of the wall from above the ceiling line and terminate at a 3 square Styrofoam "block out" in the wall and frame at the same height as the latch. This is for low-voltage electric key card latches to be installed in the future.

4.3.2.1.16 All doors opening into rated corridors or areas shall have electric hold open devices.

4.3.2.1.17 Salvage rights of door hardware by owner - notify the K-State Lock Shop 10 working days prior to demolition/construction projects. The K-State Lock Shop will remove the hardware prior to the day that the contractor will start the project.

4.3.2.2 Locksets: (rim latch devices are required; this will require a center mullion)

4.3.2.2.1 All public areas shall be served by lever-handle locksets, similar to Corbin Russwin ML2200 series.

4.3.2.2.2 All non-public areas (mechanical, custodian, serving, etc.) shall be served by knurled handle locksets, similar to Corbin Russwin ML2200 series.

4.3.2.2.3 Mortise locksets shall be used in all areas. Cylindrical style locksets will require special approval.

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4.3.2.4 All locksets shall be grade 1, and be on the approved list for KSU.

4.3.2.5 All locksets shall accept Corbin Russwin 7 pin cores or cylinders.

4.3.2.6 These brands of locksets are acceptable to the owner: Corbin Russwin and Sargent. Other brands require the approval of the owner. Brands found unacceptable to the owner are: Falcon, Yale, and Lockwood.

4.3.2.7 Any other types of locksets used must have a key override function.

4.3.2.3 Panic devices:

4.3.2.3.1 All panic devices shall be heavy-duty grade.

4.3.2.3.2 All panic devices shall be of the "touch-bar" or "cross-bar" type and shall have a dogging function.

4.3.2.3.3 Rim latch devices are preferred. In double door situations this requires a center mullion. In cases where center mullions are not desirable or not allowed by code, surface-mounted latches are preferred over concealed vertical rods.

4.3.2.3.4 These brands of panic devices are acceptable to the owner: Von Duprin, Sargent and Precision. Other brands require the approval of the owner. Brands found unacceptable are: Yale, Monarch and Dor-A-Matic. Precision should be used as a standard of quality.

4.3.2.4 Closers:

4.3.2.4.1 All closers shall be heavy-duty or institutional grade. Parallel arms are preferred.

4.3.2.4.2 Surface mounting is preferred. Other types of mounting require the approval of the owner. All doors and frames shall be reinforced at mounting locations. All screw and bolt holes shall be drilled and tapped. Self-tapping screws are not acceptable.

4.3.2.4.3 Accessible doors are preferred to be power-operated: refer to 4.3.3 for details. Those that are not power-operated shall meet the pounds-of-pull requirements of ADA.

4.3.2.4.4 All closers shall be mounted on the interior side of the door/frame whenever possible.

4.3.2.4.5 These brands of closers are acceptable to the owner: LCN, Corbin Russwin, and Sargent. Other brands require the approval of the owner. LCN should be used as a standard of quality.

4.3.2.5 Hinges:

4.3.2.5.1 All hinges shall be heavy-duty grade, ball-bearing type. All doors require 1½ pairs of hinges per door.

4.3.2.5.2 Exterior door to have pivot style hinges 1 ½ pair.
4.3.2.5.3 Hager model #1191BB should be used as a standard of quality.

4.3.2.6 Thresholds:

4.3.2.6.1 All thresholds, regardless of door configuration, shall be heavy-duty grade, constructed of aluminum and meet ADA requirements.

4.3.2.7 Colors:

4.3.2.7.1 All door hardware shall have either US 10 or US 26D finish. Other colors of hardware finish must be approved by the owner. In existing construction, the hardware color should match the existing hardware color. The standardization on colors will allow Division of Facilities to stock replacements. Some buildings have more than one color of hardware already. New hardware should match the predominant color if it is one of the two standard colors. Otherwise, the owner will pick one of the standard colors.

4.3.2.8 Keys and cylinders:

4.3.2.8.1 Early in the design phase, the architect should discuss the keying of the lock cylinders with the owner or the contractor will be responsible for the keying of the lock cylinders.

4.3.2.8.2 If the owner is to do the keying of lock cylinders, the specifications shall require the contractor to supply Corbin Russwin 7-pin cylinders with two key blanks, as required, for each lock.

4.3.2.8.3 If the contractor is responsible for the keying of lock cylinders, the contractor is required to use the Corbin Russwin Architectural Hardware Co. of Charlotte, NC. to do all keying work per the keying schedule by the owner. The contractor will supply Corbin Russwin 7-pin lock cylinders and two keys to fit each lock cylinder. The contractor will install the lock cylinders and provide location tagged keys to the owner.

4.3.2.9 Door pulls with an offset design shall not be used.

4.3.3 Power operated doors

4.3.3.1 Applications for power operated doors

4.3.3.1.1 In all new construction, all public entrances to the building shall be accessible to persons with disabilities. Any exceptions to this must be approved by the owner. The main entrance shall be provided with one door, or set of doors, that is power operated. Additionally, if an entrance to the building other than the main entrance is located closer to the parking designated for persons with disabilities, that entrance shall also be power operated.

4.3.3.1.2 The above item should be regarded as a minimum requirement. If the expected users of the building include a larger than normal percentage of persons with disabilities, other entrances to the building shall also be power operated.
4.3.3.1.3 In existing structures, a minimum of one entrance shall be accessible to persons with disabilities. That entrance shall be power operated. The accessible entrance shall be either the main entrance or the entrance closest to the parking designated for persons with disabilities.

4.3.3.2 Type of operations

4.3.3.2.1 The preferred operation is for the doors to be power operated only on demand. Without specific action the door should function as a normal door. The desire is to have the most maintenance-free installation that serves the needs of persons with disabilities. Swinging-type doors that are normally operated in a manual mode and power operated on demand is considered to be the best combination.

4.3.3.2.2 It is recognized that in some instances it will be necessary or preferred for the door to operate in a fully automatic mode. This type of installation requires the approval of the owner. It should only be considered in areas that can reasonably expect a high level of usage by persons with disabilities.

4.3.3.2.3 It is preferred that the doors be swinging-type doors. In areas that may receive high usage by persons with disabilities, sliding doors may be appropriate. This type of installation requires the approval of the owner.

4.3.3.2.4 In new construction, and in existing construction where possible, the inner and outer doors of a vestibule should operate individually. This will require the user to separately activate both doors of a vestibule. Individual operation of the inner and outer doors allows the vestibule to maintain its integrity as an airlock for energy conservation purposes.

4.3.3.2.5 In existing construction, where space is not available for individual activation, the doors should both open upon activation by the user.

4.3.3.2.6 In double door situations, only one leaf should be power operated unless the anticipated traffic levels indicate otherwise.

4.3.3.3 Activating devices

4.3.3.3.1 The preferred activating device is a push-button. This device shall be used on all non-automatic installations.

4.3.3.3.2 In installations where the operation is fully automatic, the activating devices shall be of the infrared light beam type that detects the presence of the user in a very narrow area.

4.3.3.3.3 The least preferable devices are area motion sensors and floor mats. Use of these devices should be avoided and requires the prior approval of the owner.

4.3.3.3.4 During the design phase of a project, the designer should determine the need for after-hours access by persons with disabilities. In those cases where such access is needed, additional
secure activating devices and electric strikes or locks may be required. Discuss all options with Owner prior to proceeding.

4.3.3.3.5 All installations shall be wired to support the future installation of additional secure activating devices, hold opens and electric locks or strikes.

4.3.3.3.6 Each system shall be provided with a keyed deactivation switch that is easily accessible from floor level.

4.3.3.7 Automatic opening door openers for wheelchair entry shall be Besam, Dor-o-matic or Entrance Technology, automatic openers. With touchless electronic sensor mounted on the protective handrail on each side of door. Include signs as per ADA requirements. Floor mats with sensors are not allowed.

4.3.3.4 Locking and Security

4.3.3.4.1 All installations shall be provided with positive locking devices. Simply deactivating the door operating system does not provide the security level desired.

4.3.3.4.2 The preferred locking system uses the panic devices normally found on entrance doors.

4.3.3.4.3 On those systems that require after-hours operation, the use of electric strikes is preferred. Electric locks should be avoided if possible.

4.3.3.4.4 Classrooms which require alarms:

4.3.3.4.4.1 Electric Strike - by K-State Facilities, contractor provide ½ " empty conduit from hollow metal frame to above finish clg.

4.3.3.4.4.2 Electric Key Switches - by K-State Facilities contractor provide ½" empty conduit from hollow metal frames to above finish clg.

4.3.3.4.4.3 Burglar Alarm - by K-State Facilities connected to electric strikes and key switch.

4.3.3.5 Signage

4.3.3.5.1 All signage related to power operated doors shall use the universally recognized blue symbols and characters on a white background.

4.3.3.5.2 Every power-operated door shall have the universal symbol for accessibility located near the latch side of the door. The sign should be mounted either on the wall next to the door (preferred) or on the door (if necessary), depending on the situation.

4.3.3.5.3 Every switch or other operator requiring user action shall have a sign located in close proximity to the switch. This sign shall consist of the universal symbol for accessibility and any
instructions that apply to the operation of the door. The switches are sometimes lost in the surrounding structure. These signs are to alert the users to the existence of the switches and to give instructions.

4.3.6 Equipment

4.3.6.1 Power assist equipment of any type shall not be allowed. Pneumatically actuated equipment of any type shall not be allowed.

4.3.6.2 All door operating equipment shall be rated for heavy-duty service.

4.3.6.3 In specifying and approving door-operating equipment, prime consideration shall be given to the ready availability of service and replacement parts. The following brands have support available on a timely basis at the present time: Doormatic, Stanley, Besam, Horton, and Able.

4.3.6.4 All control equipment shall be compatible with the voltage requirements of the university building security system.

4.3.6.5 All door operating equipment shall have a two year warranty.

4.3.6.6 In manual mode, no power assist of any type shall occur. The operators shall require no more than 15 lbs. to set in motion and not more than 10 lbs. to continue movement.

4.3.4 Windows

4.3.4.1 All windows shall be constructed of aluminum and shall comply with ASHRAE 90.1.

4.3.4.2 All windows shall have thermal break construction.

4.3.4.3 All windows installed in areas normally occupied by people shall be operable, except in those areas required by code to maintain a specific air balance. All operating mechanisms shall be of heavy-duty, institutional grade construction. All operable windows shall be capable of being cleaned from the interior of the building, and shall be supplied with a positive locking device.

4.3.4.4 Screens shall not be supplied with windows.

4.3.4.5 All windows installed in a building on the campus shall be the standard University medium bronze color. In existing structures, the color shall match the color of the existing windows and/or doors with the concurrence of the Owner.

4.3.4.6 In specifying windows, consideration shall be given to the replacement of broken glazing. It is preferred that replacement be possible from the interior of the building. Other types of windows require the approval of the Owner.

4.3.4.7 The details of the window installation shall provide for a thermal break between the window material and the finish material of the interior wall.

4.3.4.8 Material used for windowsills shall not include particleboard. Plastic laminate on solid wood or exterior grade plywood is acceptable. Other, more durable materials should be evaluated on a lifetime cost basis.
4.3.4.9 In existing construction, if any of the existing windows or parts of windows are removed, that material shall be returned to the owner for storage.

4.3.4.10 All window units shall comply with ASTM E283, E331, and E547. These tests shall be performed on the site after installation. The owner will retain the services of a testing company to perform these tests on window units chosen at random by the owner. If any window units fail the tests, the contractor shall be responsible for retesting.

4.3.5 Glass and glazing

4.3.5.1 All glazing in new windows, doors, storefronts, etc. shall be 1" double-pane insulated glass, and shall carry a 10-year warranty on replacement of defective material.

4.3.5.2 All glazing shall be of the low-E type.

4.3.5.3 Glazing in windows on the campus shall have a light bronze tint.
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CHAPTER 5—ROOFING SYSTEMS

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CHAPTER 5—ROOFING SYSTEMS

Section 5.1 General Requirements

5.1.1 Whenever feasible, roofs with slopes greater than 3 inches per foot should be considered.

5.1.2 On low-sloped roofs, the minimum slope shall be 1/4" per foot. On new construction, and on existing construction where possible, the slope shall be a minimum of 2" per foot.

5.1.2.1 Sloping of insulation shall not be allowed on new construction. The new roof structure needs to provide the slope — not the insulation.

5.1.2.2 Tapered insulation may be used on existing roofs to achieve proper slope to drains.

5.1.3 For low-sloped roofs, the following types are preferred: Two or Three -ply Modified Bitumen Sheet. Consider contaminants and pollutants known to be present when choosing the membrane material. The mod-asphalt membrane to meet or exceed 20 year warranty, cold application of membrane.

5.1.4 The specifications shall prohibit:

5.1.4.1 The use of any asbestos-containing materials for the entire system.

5.1.4.2 Lightweight concrete shall not be used in lieu of insulation.

5.1.4.3 Organic felts shall not be used. Modified Bitumen is required.

5.1.4.4 Pitch pans shall not be used.

5.1.4.5 Top nails shall not be used.

5.1.5 Avoid penetration and placing of equipment directly on roofs as much as possible.

5.1.6 All roofs shall have overflow systems. If overflow piping is used, the piping systems shall be separate from the regular roof drain system. Consideration should be given to the use of scuppers or other highly reliable overflow systems.

5.1.7 The specifications and drawings shall note that often the manufacturer is willing to warrant a roof system for the required period of time if details are used that are less comprehensive than the details shown in the drawings. In those cases, we require the details drawn to be used. – No exceptions!

5.1.7.1 Use a 10-year warranty as the base bid and the 20-year warranty as an alternate for all specifications.

5.1.8 New roofing systems shall not be installed over an existing roof system without removal and replacement of the old roof system.

5.1.9 The following references and guidelines should be used in roofing design:

5.1.9.1 NRCA Roofing and Waterproofing Manual, including NRCA Construction Details.
5.1.9.2 SMACNA Architectural Sheet Metal Manual.


5.1.10 The design system shall be able to meet 1-90 wind uplift ratings.

5.1.11 All roofing systems shall include the use of a vapor barrier. Review vapor barrier on a roof by roof basis with Owner to determine final needs.

5.1.12 Insulation

5.1.12.1 The insulation specified shall be compatible with the application method required and the other materials of the roofing system. Require the roofing membrane manufacturer to approve the insulation in writing. Preferred insulation is polyisocyanurate. Coverboard is ¾" fiberglass.

5.1.12.2 Where overall insulation thickness is 2" or greater, it is preferred that the insulation be installed in more than one layer with the joints staggered. For this purpose, a recovery board can be considered a layer.

5.1.12.3 Lightweight concrete insulation systems are not allowed unless prior approval of the Owner is obtained.

5.1.13 Use crickets, saddles, and edge strips to direct water flow away from penetrations and parapet walls. Provide a minimum of 2 times the roof slope to ensure resulting finished surfaces are sloped, not flat. Show all cricket layouts on the roof plan.

5.1.14 Penetrations

5.1.14.1 Minimize use of roof penetrations to the greatest extent possible. Maintain proper clearance between penetrations to allow for flashing installation. Do not install penetrations in valleys or near drains or scuppers.

5.1.14.2 Maintain a minimum of 12 inches between penetrations. Maintain a minimum of 8 feet to all roof drains and scuppers.

5.1.14.3 Show all penetrations on the roof plan and provide applicable details including detail references keyed in the roof plan or legend. Clearly show all details of the construction requirements for the deck, insulation, membrane, curbing, base flashing and counterflashing, etc. necessary to completely communicate requirements. Use of pre-manufactured pipe boots is not allowed.

5.1.14.4 All penetration flashings shall extend a minimum of 12" above the roof membrane.

5.1.14.5 All penetrations are to be through a box; pitch pans are not allowed.

5.1.15 Equipment Supports

5.1.15.1 Use round shapes to construct equipment supports. Equipment supports should be as shown below. Note that these minimum apply at the end of the equipment support on the upslope side of the framing.

5.1.15.2 Width of Equipment Height of Legs above Membrane
5.1.16 Flashings

5.1.16.1 Copper is the preferred material for flashings and removable counterflashings. Galvanized sheet metal shall not be used. Other materials may be considered based on prior Owner approval.

5.1.16.2 On new construction, and on existing construction whenever feasible, install counterflashings a minimum of 12" above the roof system.

5.1.16.3 Before designating sheet metal items for reuse in reroofing work, consider whether the component can withstand removal, reinstallation, bending, or resetting without damage and as necessary to perform its intended function.

5.1.16.4 Where fascia replacement is required, the preferred system is a two-piece system similar to Anchor-Tite as manufactured by Metal-Era Roof Edge Systems.

5.1.17 Walkways shall be provided to all roof-mounted equipment.

5.1.18 The designer shall consider the need for snowguards or ice breakers, especially on roofs with eaves over sidewalks.

5.1.19 Required elements common to KSU roof projects include placement of roof hatches, ladders between roof levels, hose bibs and electrical access on each roof level. Metal expansion joints only – no neoprene materials are allowed on KSU projects.

Section 5.2 Modified Bituminous Systems

5.2.1 Modified Bitumen Sheet (MBS) – Refer to the detailed specification draft used on all KSU roofing projects for greater detail of requirements.

5.2.1.1 All MBS roofs shall be designed to 20-year standards, regardless of the warranty period. Refer to 5.1.7.1 for requirements of bid specifications.

5.2.1.2 All MBS systems shall use a layer of recovery board.

Section 5.3 Metal Systems

5.3.1 Metal roofing systems shall be of the standing seam type only. The minimum height for the seam is 1 ¾ ".

5.3.2 Minimum metal thickness is 24 gauge.

5.3.3 In the field, mechanically crimped seams are preferred. Other types of seams may be considered. However, seams utilizing a “U” clip will not be considered.

5.3.4 The minimum slope for metal roofing systems is 1" per foot.

5.3.5 All panels shall be continuous with no lateral splices.
5.3.6 The roof support systems shall be designed for the anticipated loadings per UBC code, but in no case shall the metal be required to span more than 5’.

5.3.7 All clips shall be concealed and shall allow for expansion and contraction of the metal.

5.3.8 All accessories shall be pre-manufactured and approved as a part of the roofing system.

5.3.9 All fasteners shall be stainless steel.

5.3.10 Underlayment shall be a minimum of 15 Lb. felt. Other systems may be considered.

5.3.11 For those roofs that need to be colored for aesthetic reasons, the standard of quality for the color finish is Penwalt Corp. Kynar 500 resin. Roofs that do not need to be colored shall have a “Galvalum” finish.

Section 5.4 Other Systems

5.4.1 Asphalt Shingles

5.4.1.1 Architectural laminated asphalt shingles shall be warranted for 40 years and must be of the sealtab lam. type TAMKO Heritage 40 “Oxford Gray” to match the University standard color.

5.4.1.2 The minimum roof slope for fiberglass shingles is 3” per foot.

5.4.1.3 All fiberglass shingles shall have an underlayment of a minimum of two layers of 30 Lb. felt.

5.4.1.4 A galvanized drip edge shall be installed on all fiberglass shingle roofs.

5.4.2 Single Ply Membrane Systems

5.4.2.1 As a matter of course this is not a preferred roofing system on the main and Vet Med campus. Examples of this type do exist. Discuss with Owner prior to considering this system.

5.4.3 Spray On Foam System

5.4.3.1 Limited trials of a sprayed-on system are under trial applications on the main campus. Discuss with owner prior to considering the system.
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6.1.1 For wet areas or wash down areas the following wall system is preferred: Concrete masonry unit (CMU) wall, 1/8" fiberglass panel bonded to the CMU wall with mastic, and nylon anchors.

6.1.2 Stairwells and elevator shafts are preferred to have masonry or concrete construction. Floors in stairwells shall be hard surfaced with a slip resistant covering.

6.1.3 All mechanical rooms shall have concrete floors and masonry or concrete walls.

6.1.4 The designer shall carefully evaluate the need for sound proofing for all walls.

6.1.5 In corridors and other public areas, no wall covering shall be used.

6.1.6 Ceramic Tile shall not be used in restrooms.

6.1.7 All color selections for all materials shall be listed in the specifications.

6.1.7.1 Wall paint selections shall be made from the prison paint palette.

6.1.8 For conference rooms and similar areas the designer shall evaluate the need for chair rails to prevent wall damage.

Section 6.2 Floor and Room Numbering

6.2.1 The Division of Facilities Planning shall review and provide final approval of all newly assigned room numbers to match the standard University Numbering system. The designer shall use the University numbering system in lieu of the typical architectural system for numbering.

6.2.2 At the initial design development phase and throughout the design and construction phases, room numbers shall be altered only as needed to comply with the following guidelines.

6.2.3 Floors shall be numbered beginning with the lowest floor that has a grade level entrance. The floor that is immediately below the first floor shall be called the basement. Floors below the basement shall be called the first sub-basement, second sub-basement, etc., as needed.

6.2.4 Room numbering:

6.2.4.1 Sub-basement rooms shall be labeled by alpha indicators only.

6.2.4.2 Basement rooms shall be labeled with numbers 001-099.

6.2.4.3 First floor rooms shall be labeled with numbers 101-199, second floor rooms with numbers 201-299, etc.

6.2.4.4 For new buildings, or additions to existing buildings, with more than 100 rooms per floor, the numbering system shall consist of 4 digits.

6.2.4.5 The University numbering systems skip ending room numbers in 5’s and 10’s for future use.
6.2.4.6 Rooms that are not accessible from a corridor or common area shall be numbered by the use of an alpha suffix. The prefix and the number shall be the same as the room through which common access is available. For example, rooms accessible through room E101 shall be numbered E101A, E101B, etc. Do not use alpha prefixes for major room numbers.

6.2.4.7 Rooms that are not accessible from a corridor or common area and are at a different level than the room that provides access shall be called mezzanines. Mezzanines shall be numbered according to paragraph 6.2.4.6, above.

6.2.4.8 If a room is subdivided into more than one room and the new rooms created are accessible from the corridor or common areas, and if room numbers in the appropriate sequence are not available for use, the original room number shall be retained and numerical suffixes (-1, -2, -3, etc.) shall be used for each new room created.

6.2.4.9 For remodeling projects that require new room numbers: the new room numbers shall fall between room numbers not being remodeled. 5’s and 10’s can be used if needed.

6.2.4.10 Rooms that span more than one floor shall be numbered according to the main level entrance to the room if one entrance is on the main level. If no entrance is on the main level, the room shall be numbered according to the entrance closest to the main level.

6.2.4.11 The main corridor shall be numbered 100, 200, 300, etc. on the first, second, third, etc. floors. Other corridors, stairwells, vestibules, and elevators shall be numbered using the number of the main corridor with the addition of an alpha suffix, applies in a clockwise fashion.

6.2.4.12 Room numbers shall be applied by beginning at the Northeast corner of the building, numbering each room or area in a clockwise direction. Where corridors are present, even/odd numbers may be used to differentiate sides of the corridor. The same clockwise convention shall be used in applying the alpha suffix to rooms not directly accessible from a corridor or common area.

Section 6.3 Wall Types

6.3.1 Stud and drywall

6.3.1.1 For new construction and major renovations, studs for drywall construction shall be metal. For minor renovations, metal or wood studs may be used. When metal studs are used, 20 gauge shall be the minimum thickness of the metal.

6.3.1.2 Drywall shall be a minimum of 5/8” thickness. Always specify type “X” drywall as a rule. The need for water resistant type drywall should be considered. Water-resistant drywall shall be used in all rest rooms, wash rooms, custodial closets, animal rooms, etc.

6.3.1.3 The drywall shall be attached to the studs with screws and glue.

6.3.1.4 A minimum of three coats of drywall finishing material (tape and mud) shall be used.

6.3.2 Modular
6.3.2.1 The use of full-height-modular-wall systems is not preferred. This type of wall should be used only to match existing conditions.

Section 6.4 Wall Finishes

6.4.1 Facilities will provide prison paint to all contractors at cost to the project.

6.4.1.1 Flat paint may be used on walls. The preferred finish is “egg shell” or semi-gloss.

6.4.1.2 Flat paint may be used on ceilings.

6.4.1.3 Door and window trim shall be a minimum of oil base, stain finish. Semi-gloss may also be used.

6.4.1.4 For woodwork, the minimum finish shall be oil base, stain finish. Urethane is the preferred material for woodwork finishes.

6.4.1.5 If epoxy paints are needed, two-part epoxies are preferred.

6.4.1.6 For high-use areas consideration should be given to the use of modified acrylate copolymer multi-color coating similar to Zolotone, Polomyx, or Duoplex.

6.4.1.7 All walls shall be primed as required by the paint manufacturer.

6.4.2 Ceramic tile

6.4.2.1 The use of ceramic tile in new installations is not allowed.

6.4.2.2 Existing ceramic tile shall be restored if possible. If not possible, it is to be removed and replaced with other materials.

6.4.3 Wall covering

6.4.3.1 Wall covering shall not be used in public or high traffic areas. In general it should be used only in private offices, conference rooms, or other low traffic areas. In these places it should be used sparingly due to the high cost and difficulty of repair and maintenance.

6.4.3.2 All wall covering shall be easily cleanable. Highly textured wall covering or other types of designs that do not lend themselves easily to cleaning shall not be used.

6.4.3.3 The minimum grade of wall covering acceptable is commercial grade. If vinyl wall covering is used it shall be Type II.

6.4.4 Specialty finishes

6.4.4.1 Finish systems similar to Dryvit should not be used except at specific athletic facilities.

6.4.4.2 Thin coat veneer plaster is considered to be a good durable finish. It is particularly useful when matching existing plaster walls.
6.4.4.3 Acoustical panels shall be used sparingly due to the high initial cost and the difficulties of maintenance. If they are used, the need for a chair rail shall be considered. Acoustical panels shall be terminated a minimum of 4” above the finished floor level to prevent damage from vacuum cleaners.

Section 6.5 Ceilings

6.5.1 General requirements

6.5.1.1 No concealed spline or tongue-and-groove type ceiling tiles shall be used.

6.5.1.2 Suspended grid type ceilings are preferred. Avoid the use of drywall on ceilings.

6.5.2 Suspended grid

6.5.2.1 Ceiling tile of 2’ x 2’ size Armstrong 770 “Cortega” is generally preferred for the cost savings. Other sizes and types may be considered as required, but need prior approval of Facilities Planning.

6.5.2.2 If other design considerations do not apply, use Armstrong 755B ceiling tiles. Do not use Mylar or foil faced fiberglass unless matching existing tile. Consideration should be given to the use of tiles with non-sag warranties in high humidity or unconditioned spaces.

6.5.2.3 Suspend the ceiling grid directly from the building structure. Do not hang other objects from the ceiling support system. All light fixtures, HVAC boxes, speakers, etc. shall be supported independently of the ceiling support system.

6.5.2.4 The standard of quality for the grid system is the 15/16” wide Chicago metallic 200 snap grid system.

6.5.3 Drywall ceilings, when used, shall be a minimum of 5/8” Type “X” drywall, screwed to the support system, with a smooth finish.

6.5.4 Concrete, when exposed in occupied areas, shall be provided with a finish free of form defects, pitting, etc.

Section 6.6 Floors

6.6.1 General requirements

6.6.1.1 Do not mix types of floor covering within a room.

6.6.1.2 Use of carpet in high traffic or high abuse areas should be avoided.

6.6.1.3 The preferred floor covering for most areas is vinyl composition tile.

6.6.1.4 Particular attention shall be given to the preparation of the subfloor. Lack of good preparation often causes problems with floor coverings.

6.6.2 Carpet

6.6.2.1 Carpet tiles are generally not preferred. Use carpet tiles only if needed due to the physical aspects of the space.
6.6.2.2 If carpet is used in high traffic areas, the color shall be a dark color chosen to hide soil. The carpet for these areas shall be chosen for the ability to withstand traffic and abuse.

6.6.3 Vinyl composition tile (VCT)

6.6.3.1 All tile shall be minimum of 1/8” thick.

6.6.3.2 Particular attention shall be given to the preparation of the subfloor.

6.6.3.3 It is preferred that VCT be used in rest rooms.

6.6.3.4 Tile installed on slopes or inclines shall be slip resistant.

6.6.4 Ceramic tile

6.6.4.1 The use of ceramic tile in new installations is not allowed.

6.6.4.2 Existing ceramic tile shall be restored if possible. If not possible, it is to be removed and replaced with other materials.

6.6.5 Quarry tile is acceptable as the budget allows.

6.6.6 Vinyl sheet goods are acceptable in specific applications requiring prior approval. If used, particular attention shall be paid to the seaming method and the subfloor preparation.

6.6.7 Epoxy resin floors shall be trowel-applied, with a minimum thickness of 1/8” and integral curbs. The color shall be integral to the flooring material, not a surface coating.

Section 6.7 Signage

6.7.1 All signage shall meet the requirements of the current version of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and the University Signage Standards.

6.7.2 The preferred color arrangement is light colored characters or symbols on a dark background. All signs within a building shall be the same color. The preferred colors are Coffee Bean for the background with white characters and symbols. Other colors may be considered on a case-by-case basis.

6.7.3 Placement

6.7.3.1 Signs shall be installed on the wall adjacent to the latch side of the door whenever possible. If wall space is not available on the latch side of the door, coordinate the placement of the sign with the project manager. Meet all other requirements of ADAAG when choosing an alternate placement.

6.7.3.2 Mounting height shall be 60” above the finished floor to the centerline of the sign. Mount signs flush with the door trim.

6.7.3.3 Do not mount signage on or above doors.

6.7.3.4 Consult with Mark Taussig (785) 532-6377 for the specifics of the signage design.

Section 6.8 Specialties
6.8.1 Rest room accessories

6.8.1.1 The preferred toilet paper dispenser is a lockable dispenser constructed of stainless steel. (That holds 2 rolls that are 5 ½” or larger in diameter. A unit meeting these specifications is made by American Specialties, Inc.)

6.8.1.2 The sanitary napkin dispenser unit should be a wall-mounting type that is stainless steel. The dispenser shall measure 27” high x 17” wide x 4 ¼” deep. This unit must have fifty-cent coin units. A unit meeting these specifications is made by American Specialties, Inc.

6.8.1.3 The sanitary napkin disposal unit should be stainless steel with a hinged top lid. The receptacle is to be stainless steel with a satin finish. Receptacle size should be 11” high x 5 ¾” wide x 4 ½” deep. A unit meeting these specifications is made by American Specialties, Inc.

6.8.1.4 Electric hand dryers that are automatic on/off are preferred for all restrooms. These units should have a durable enamel finish to resist chipping, measuring 9 5/8” high x 11 3/8” wide x 6 5/8” deep. A unit meeting these specifications is made by American Specialties, Inc.

6.8.1.5 Soap dispensers will be the type that are sanitary sealed refill pouch. The pouch must empty completely. The dispenser must have an anti-clog valve with each push-pack refill. Refills shall be disposable to eliminate messy reloading and clean up. The dispenser shall have a no-drip, no-leak valve tip. The dispenser shall have a concealed “lock”, virtually vandalism proof. The dispenser shall be of tough, high impact ABS construction. Liquid soap pouch must be an individual box. The measurements of the unit are 11 ¼” high x 5” wide x 4” deep. These dispensers are on current state contract and are Sani-Fresh sold by Massco.

6.8.1.6 All accessories must follow campus ADA standards.

Section 6.9 Custodial and Storage Rooms

6.9.1 Custodial Closet

6.9.1.1 Size: Minimum size requirements – 5’ by 6’ with door opening out or 5’ by 8’ with door opening into the room.

6.9.1.2 Ceiling Height: 8’ minimum ceiling height.

6.9.1.3 Doorways: Minimum measurement of 3’ wide by 6’-8” high. These measurements do not include a door sill or center post.

6.9.1.4 Custodial closets are not to be used for placement of other building systems, related equipment or services.

6.9.1.5 In larger buildings an office of 160-180 square feet is required to manage all custodial activities.

6.9.1.6 Review 8.2.6.2 for data on plumbing needs and equipment in custodial closets.

6.9.2 Storage Rooms/Closets

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6.9.2.1 Minimum of one closet per floor for filter and lights storage. Size should be adequate to accommodate the filters for all units and any lights on that floor.

6.9.3 Telecommunications Rooms

6.9.3.1 Location: A minimum of one telecommunications closet shall be located on each floor. Distance limitations or other considerations may require more than one closet on each floor. Closets should be located as close to the core of the structure as possible and should be stacked one above the other in multiple floor buildings.

6.9.3.2 Size similar in size to custodial rooms see 6.9.1.1 and 6.9.1.2
CHAPTER 7 – CONVEYANCE SYSTEMS
CHAPTER 7—CONVEYANCE SYSTEMS

Section 7.1 Elevators

7.1.1 Compliance with ADA

7.1.2 Information Plate

7.1.3 Controls
   7.1.3.1 Control Systems - Repair
   7.1.3.2 Vandalism – Resistant Design
   7.1.3.3 Fireman Recall System

7.1.4 Servicing
   7.1.4.1 Response to Non-Emergency Calls
   7.1.4.2 Contract Bid Form
   7.1.4.3 Warranty Period
   7.1.4.4 Monthly Inspection Reports

7.1.5 Vandalism

7.1.6 Preferred Type - Hydraulic

7.1.7 Lighting - Fluorescent

7.1.8 Telephone Equipment - Compatibility

7.1.9 Proximity Detectors

7.1.10 Floor Covering

7.1.11 PVC Containment Piping

7.1.12 New Elevators

Section 7.2 Elevator Maintenance Contract
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CHAPTER 7---CONVEYANCE SYSTEMS

Section 7.1 Elevators

7.1.1 All elevators must comply with the latest version of the Americans with Disabilities Act and ANSI A17.

7.1.2 All elevators shall have an information plate permanently attached listing the maximum weight capacity of the elevator.

7.1.3 Controls

7.1.3.1 All elevator control systems shall be such that ANY elevator repair company is able to troubleshoot, repair, maintain, or adjust the control system. No proprietary software or repair tools shall be allowed. If an elevator control system has such software or repair tools, the complete codes, tools, or other necessary means for monitoring or repairing the control system shall be supplied to the owner at the time of installation. If updates or changes are required, these shall also be supplied to the university at no additional cost.

7.1.3.2 All elevator controls and indicators shall use a vandalism-resistant design.

7.1.3.3 All elevators shall be equipped with a fireman’s recall system in accordance with ANSI A17.1, 211.3. Car and hall key switches shall be operated by Chicago ACE 7 pin tumbler locks, combined to the fireman service control master XX3835. One fireman recall system key per elevator shall be furnished.

7.1.4 The installing vendor shall be responsible for all maintenance and service during the warranty period.

7.1.4.1 Response to non-emergency service calls shall be within four hours of the call. Response to emergency service calls shall be within 2 hours of the call. The vendor shall be financially responsible for these calls except those caused by power outages, acts of God, vandalism, and false reports.

7.1.4.2 The contract bid form shall provide for a unit price for the hourly labor rate for these service calls at both the standard rate and overtime rate.

7.1.4.3 During the warranty period, contractors will be required to adhere to the maintenance contract. During the last month of the warranty period, the contractor will perform the ASME 17.1 Section 10 requirements for new elevators.

7.1.4.4 The contractor will be required to submit monthly inspection reports as to the contract.

7.1.5 For each installation, the designer shall evaluate the expected usage of the elevator to determine the need for vandalism-resistant construction.

7.1.6 The preferred type of elevator is hydraulic.

7.1.7 All elevator lighting shall be fluorescent.

7.1.8 All telephone equipment shall be compatible with the University telecommunications system.

7.1.9 Proximity type detectors shall be used on elevator doors.
7.1.10 The designer shall evaluate the expected use of the elevator when choosing the floor covering. In academic and research areas with high student or high traffic use, the preferred covering is vinyl tile. In administrative areas with low office type use carpet may be considered. If carpet is used, carpet tiles are preferred for ease of replacement. Use of carpet requires prior approval.

7.1.11 All hydraulic elevators shall be equipped with PVC containment piping encasing the cylinder ram and casing. The containment shall be installed subsurface and shall be sealed at the bottom. Provide a means of testing the bottom seal and a means of evacuating any material that may enter the containment. Prevent any materials from entering the top of the containment.

7.1.12 All new elevators need to include bumper and wall pads.
Section 7.2 Elevator Maintenance Contract

BID SPECIFICATIONS

1. LOCATION: (Provide description of Building and refer to drawings to locate elevator.)

2. For good cause, and as consideration for executing this contract, the contractor, acting herein by and through its authorized agent, hereby conveys, sells, assigns and transfers to the State of Kansas all rights, title and interest in and to all causes of action it may now, or hereafter acquire under the anti-trust laws of the United States and the State of Kansas, relating to the particular products or services purchased or acquired by the State of Kansas pursuant to this contract.

3. PATENTS: The contractor shall hold and save the State, its officers, agents, servants and employees harmless from liability of any nature or kind, including costs and expenses for, or on account of, any patented or unpatented invention, article or appliance manufactured or used in the performance of this contract.

5. LIABILITY: The contractor shall not be liable for injuries or damage to persons or property except those directly due to his own acts or omissions. The contractor shall not be liable for any loss, damage or delay caused by strikes, lockouts, fire, explosion, theft, floods, riot, civil commotion, war, malicious mischief, acts of God or any cause beyond his reasonable control. The contractor shall furnish proof of liability insurance in amounts of $500,000.00 for each claim, $1,000,000.00 maximum.

6. All work shall be performed by skilled elevator persons directly employed and supervised by the contractor.

7. All work shall be performed during regular working hours of regular working days of the trade. If at any time it should become necessary to perform any overtime work, the contractor must have authorization in writing by State officials.

8. The contractor will be responsible for supplying, repairing, and replacing all parts of all description other than those identified and listed under “Items Not Covered By Contract.” Materials to be used shall be genuine parts of the same material and chemical compositions as manufactured by the company furnishing the elevators or appliances. The State of Kansas recognized equivalencies. The contractor shall have, and maintain on hand locally, a supply of spare parts sufficient for the normal maintenance and repair of the elevators. The contractor shall not be required, under this agreement, to install new attachments as may be recommended or directed by the insurance companies or by Federal, State, Municipal or Governmental authorities. The contractor will notify the State agency of the part not covered by the contract so the State may put out for bid. Work performed or parts replaced without written authorization by the State will be at the contractor’s own expense. All replaced parts will be given to the Kansas State University Facilities Electric Shop supervisor.

9. STATE’S RIGHT TO INSPECTION AND TEST: The State reserves the right to make such inspections and tests as and when deemed advisable to ascertain that the requirements of these specifications are being fulfilled. Should it be found the standards herein specified are not being satisfactorily maintained, the State may immediately demand that the contractor place the elevators in condition to meet these requirements. If the contractor fails to comply with such demands within a reasonable time, the State may give written notice to the contractor and terminate his right to proceed further with the work. In such event, the State may take over work and prosecute it to completion, by the contract or otherwise and the contractor and his sureties (if any) shall be liable to the State for any excess cost occasioned the State thereby.
10. **MANNER AND TIME OF CONDUCTING THE WORK**: The contractor shall be responsible for regular and systematic examinations, adjustments, cleaning and lubrication monthly, or more often if necessary to provide efficient and safe operation of the cars is required. All lubricants, cleaning materials, paint, cotton waste, etc., are to be supplied by the contractor. All lubricants shall be of the proper grade recommended by the manufacturer for the purpose used.

Providing emergency call-back service, which shall consist of promptly responding to request from the State for emergency service at all hours of all days. Failure to respond to such emergency call, within two (2) hours after such call is made, may be justification for cancellation of the contract. Emergency response service is of particular importance because these are handicap-access elevators. The contractor bears all responsibility for responding to all calls as reported to the contractor by the State; these service calls will be included in the original contract and not charged as a service separate from the contract. When an elevator is out of service, it will be the responsibility of the contractor to establish written and properly displayed notification on all floors serviced by the out of use elevator. Before the installation is put back in service, it shall be subject to all of the required routine and periodic tests and inspections of the one-year test (ASME A17.1 sec. 10, rule 1000.3).

11. **REQUIRED TESTS AND INSPECTIONS** (master forms attached)

**INSPECTIONS FOR ELECTRIC ELEVATORS:**
- Six-month inspection (ASME A17.1 sec. 10, rule 1001.2: 1996 Code)
- One-year inspection (ASME A17.1 sec. 10, rule 1002.2: 1996 Code)
- Five-year inspection (ASME A17.1 sec. 10, rule 1002.3: 1996 Code)

**INSPECTIONS FOR HYDRAULIC ELEVATORS:**
- Six-month inspection (ASME A17.1 sec. 10, rule 1004.2: 1996 Code)
- One-year inspection (ASME A17.1 sec. 10, rule 1005.2: 1996 Code)
- Three-year inspection (ASME A17.1 sec. 10, rule 1005.3: 1996 Code)
- Five-year inspection (ASME A17.1 sec. 10, rule 1005.4: 1996 Code)
KANSAS STATE UNIVERSITY
Monthly Electric Elevator Inspection
(ASME A17.1, sec. 10, 1001.2: 1996 Code)

Building: _________________________________________ Elevator: ________________________
Date: ___________________ Time: ________________ Inspected By: ______________________

INSIDE CAR INSPECTION:

____ 1) Door reopening device       ____ 10) Power closing of door or gates
____ 2) Stop switch                   ____ 11) Power opening of doors or gates
____ 3) Operating car device          ____ 12) Car enclosure
____ 4) Car floor and landing sill   ____ 13) Emergency exit
____ 5) Car lighting                  ____ 14) Ventilation
____ 6) Car emergency signal          ____ 15) Signs and operating device symbols
____ 7) Car door or gate               ____ 16) Rated load, platform area, data plate
____ 8) Door closing force            ____ 17) Restricted opening of car
____ 9) Car ride

MACHINE ROOM INSPECTION

____ 1) Access to machine space       ____ 16) Traction drive machines
____ 2) Head room                     ____ 17) Gears and bearings
____ 3) Lighting and receptacles      ____ 18) Winding drum machine
____ 4) Enclosure of machine space    ____ 19) Belt-or chain-drive machine
____ 5) Housekeeping                  ____ 20) Motor generator
____ 6) Ventilation                   ____ 21) Absorption of regenerated power
____ 7) Fire extinguisher             ____ 22) AC drives from a DC source
____ 8) Pipes, wiring & ducts         ____ 23) Traction sheaves
____ 9) Guards for auxiliary equipment ____ 24) Secondary & deflector sheaves
____10) Numbering of elevators, machines & ____ 25) Rope fastenings
____11) Disconnecting means & controls ____ 26) Terminal stopping device
____12) Controller wiring, fuses, grounding ____ 27) Slack rope devices
____13) Static control                ____ 28) Governor, overspeed switch & seal
14) Overhead beam & fastenings
15) Drive machine brake

TOP-OF-CAR INSPECTION

1) Top-of-car stop switch
2) Car top light & outlet
3) Top-of-car operating device & working platforms
4) Top counterweight clearance
5) Car, overhead & deflector sheaves
6) Normal terminal stopping devices
7) Final terminal stopping devices
8) Broken rope, chain, tape switch
9) Car leveling devices
10) Crosshead data plate
11) Top emergency exit
12) Counterweight safeties
13) Hoistway construction
14) Hoistway smoke control
15) Floor & emergency identification numbering
16) Pipes, wiring & ducts
17) Top-of-car clearance & refuge space
18) Counterweight and counterweight buffer
19) Hoistway clearances
20) Multiple hoistways
21) Traveling cables & junction boxes
22) Door & gate equipment
23) Car frame & stiles
24) Guide rails fastening & equipment
25) Governor rope
26) Governor releasing carrier
27) Wire rope fastening & hitch plate
28) Suspension rope
29) Compensation ropes & chains
30) Windows, projections, recesses & setbacks

OUTSIDE HOISTWAY INSPECTIONS

1) Car platform guard
2) Hoistway doors
3) Vision panels
4) Hoistway door locking devices
5) Access to hoistway
6) Power closing of hoistway doors
7) Sequence operation
8) Hoistway enclosure
9) Elevator parking devices
10) Emergency doors blind hoistways
11) Separate counterweight hoistway
12) Standby power section switch
PIT INSPECTION

1) Bottom clearance & runby
2) Car & counterweight buffer
3) Final terminal stopping devices
4) Normal terminal stopping devices
5) Pit access, lighting & stop switch & condition
6) Traveling cables
7) Governor-rope tension devices
8) Car frame & platform
9) Car safeties & guiding members
10) Compensating chains, ropes, & sheaves
KANSAS STATE UNIVERSITY
One-Year Electric Elevator Inspection
(ASME A17.1, sec. 10, 1002.2: 1996 Code)

Building: ________________________________    Elevator: ________________________________

Date: _______________    Time: _____________    Inspected By: _____________________________

1)  Test oil buffers

__________________________________________________________________________________

2)  Inspect and test safeties

__________________________________________________________________________________

3)  Inspect and manually operate governors

__________________________________________________________________________________

4)  Inspect and operate manually slack – rope devices on winding drum machines

__________________________________________________________________________________

5)  Inspect and test normal and final terminal stopping devices

__________________________________________________________________________________

6)  Inspect and test firefighter’s service

__________________________________________________________________________________

7)  Inspect and test power operation of door system

__________________________________________________________________________________

8)  Test broken rope, tape, or chain switch

__________________________________________________________________________________
KANSAS STATE UNIVERSITY
Monthly Hydraulic Elevator Inspection
(ASME A17.1, sec. 10, 1004.1: 1996 Code)

Building: ________________________________    Elevator: ________________________________
Date: _________________    Time: ________________    Inspected By: _________________________

INSIDE CAR INSPECTION:

____ 1) Door reopening device    ____ 10) Power closing of door or gates
____ 2) Stop switch    ____ 11) Power opening of doors or gates
____ 3) Operating car device    ____ 12) Car enclosure
____ 4) Car floor and landing sill    ____ 13) Emergency exit
____ 5) Car lighting    ____ 14) Ventilation
____ 6) Car emergency signal    ____ 15) Signs and operating device symbols
____ 7) Car door or gate    ____ 16) Rated load, platform area, data plate
____ 8) Door closing force    ____ 17) Restricted car opening
____ 9) Car ride

MACHINE ROOM INSPECTION

____ 1) Access to machine space    ____ 11) Numbering of elevators, machines, & disconnect switches
____ 2) Head room    ____ 12) Disconnecting means & controls
____ 3) Lighting and receptacles    ____ 13) Controller wiring, fuses, grounding
____ 4) Enclosure of machine space    ____ 14) Hydraulic power unit
____ 5) Housekeeping    ____ 15) Relief valves
____ 6) Ventilation    ____ 16) Control valve
____ 7) Fire extinguisher    ____ 17) Tanks
____ 8) Pipes, wiring & ducts    ____ 18) Supply line & shutoff valve
____ 9) Guards for auxiliary equipment    ____ 19) Flexible hydraulic hose & fitting assemblies
____ 10) Governor, overspeed switch, & fitting assemblies seal    ____ 20) Pressure switch
TOP-OF-CAR INSPECTION

1) Top-of-car stop switch
2) Car top light & outlet
3) Emergency terminal speed limiting devices
4) Top-of-car operating device
5) Anti-creep leveling device
6) Normal terminal stopping devices
7) Slack rope device
8) Traveling sheave
9) Hoistway construction
10) Crosshead data plate
11) Top emergency exit
12) Hoistway smoke control
13) Floor & emergency identification numbering
14) Pipes, wiring & ducts
15) Top-of-car clearance & refuge space
16) Governor, safety, ropes & fitting counterweights
17) Hoistway clearances
18) Multiple hoistways
19) Traveling cables & junction boxes
20) Door & gate equipment
21) Car frame & stiles
22) Guide rails fastening & equipment
23) Governor rope
24) Governor rope releasing carrier
25) Wire rope fastening & hitch plate
26) Windows, projections, recesses & setbacks
27) Suspension rope

OUTSIDE HOISTWAY INSPECTIONS

1) Car platform guard
2) Hoistway doors
3) Vision panels
4) Hoistway door locking devices
5) Access to hoistway
6) Power closing of hoistway doors
7) Sequence operation
8) Hoistway enclosure
9) Elevator parking devices
10) Emergency doors blind hoistways
11) Firefighter’s service
12) Standby power selection switch
PIT INSPECTION

___ 1) Bottom clearance & runby
___ 2) Plunger & cylinder
___ 3) Car buffer
___ 4) Normal terminal stopping devices
___ 5) Guiding members
___ 6) Pit access, lighting, & stop switch & condition

___ 7) Traveling cables
___ 8) Governor-rope tension device
___ 9) Car frame & platform
___ 10) Car safety
___ 11) Supply piping
Building: ________________________________    Elevator: ________________________________
Date: _________________    Time: _____________    Inspected By: _____________________________

1) Test relief valve setting and system pressure

__________________________________________________________________________________

2) Inspection and test all pressurized valves and piping except for hydraulic cylinders

__________________________________________________________________________________

3) Inspect and test normal and final stopping devices

__________________________________________________________________________________

4) Inspect and test governors

__________________________________________________________________________________

5) Inspect and test safeties

__________________________________________________________________________________

6) Inspect and test oil buffers

__________________________________________________________________________________

7) Inspect and test operation of elevators under fire or other emergency conditions

__________________________________________________________________________________

8) Inspect and test power operations of door system

__________________________________________________________________________________

9) Inspect and test emergency terminal speed limiting device and emergency terminal stopping device

__________________________________________________________________________________

10) Test flexible hose and fitting assemblies and attach metal tag indicating date of the test and name of person or firm who performed the test in a permanent manner

__________________________________________________________________________________

11) Test pressure switch

__________________________________________________________________________________

12) Test slack rope device

__________________________________________________________________________________
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CHAPTER 8—MECHANICAL SYSTEMS

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CHAPTER 8---MECHANICAL SYSTEMS

Section 8.1 General Mechanical Guidelines

8.1.1 The designer is notified that the campus water distribution system operates at 90-100 psi. This may create the need for pressure reducing stations or other special considerations for specific applications. Designer is to verify pressure in lines prior to beginning design.

8.1.2 All motors shall be high efficiency.

8.1.3 All piping systems shall be labeled with the type of service and the direction of flow. Insulated piping shall be labeled as “non-asbestos.”

8.1.4 Mechanical joint piping systems (Victaulic, etc.) shall be used only for fire protection systems. This type of joint system can NOT be used on KSU chilled and/or hot water systems.

Section 8.2 Building Plumbing Systems

8.2.1 General guidelines

8.2.1.1 Access doors

8.2.1.1.1 Access doors shall be supplied for all concealed valves or other equipment that may require operation or adjustment.

8.2.1.1.2 The access doors shall have a minimum size of 24" x 24". In some instances, this size may not be possible. The doors should be sized to allow access to the valves or other equipment.

8.2.1.1.3 Both the mechanical and architectural drawings shall note the need for access doors, the number of doors needed, and the general locations. Exact locations are not desired. The design should require that access doors be located to allow access to the valves or other equipment. A problem often arises because the access doors were not noted on the ceiling drawings or in the ceiling specification. Exact locations are not wanted because an exact location that may work during design may not work after construction is started.

8.2.1.1.4 Access doors shall have keyed locks.

8.2.1.2 Thermometers and gauges

8.2.1.2.1 All thermometers and gauges shall have dial faces between 2" and 5" in diameter. All thermometers installed more than 8' from floor level shall have a minimum dial face of 6" and shall be installed to allow reading from floor level. (See also 8.6.5.5.4)

8.2.1.2.2 All thermometers shall be of the dry well type. All thermometers shall be installed with thermal conductive material in the dry wells. Installation without the thermal conductive material yields inaccurate readings.
8.2.1.2.3 All thermometers and gauges shall be selected with the expected operating conditions near the middle of the range of the device.

8.2.1.2.4 Thermometers and pressure gauges shall be accurate to 1% of full scale.

8.2.1.2.5 All gauges shall be installed with gauge cocks.

8.2.1.2.6 All CW and HW systems should have thermometers as well as pressure gauges installed on both supply and return lines and/or on both sides of pumps. No Pete's plugs are allowed.

8.2.1.3 Metering

8.2.1.3.1 All meters will be coordinated with KSU Utility Systems. The designer should coordinate the sizing of the meters with that office. The contractor shall be responsible for the purchase and installation of the meter.

8.2.1.3.2 All fluid meters shall be installed with a three valve bypass design. The bypass valve shall be full flow and capable of being locked. The valves shall be OS&Y rising stem gate valves. The meters shall be installed in a straight run with no obstructions 10 diameters upstream and 5 diameters downstream. All meter installations shall have 40” of clear space above the location of the meter. This is to allow the meter to be serviced without a water outage. The lock is to prevent operation of the bypass mode without the knowledge of KSU Utility Systems.

8.2.1.3.3 All meters shall be connected to telemetering panels supplied by contractor, per current KSU utility systems specifications. The contractor is responsible for mounting the panels, supplying the necessary 110v power, and connecting the meters to the panels. The meters shall be connected to the panels with 16 gauge, 3 conductor, shielded, stranded control wire. Terminations and startup will be completed by KSU Utility Systems.

8.2.1.4 A water-sampling tap shall be installed on all water mains upon entering the building. The tap shall consist of a 1” tap with a ball valve installed at the 12 o’clock position. Two 90° elbows shall be installed to direct the water flow toward the floor, similar to a faucet. Locate tap so that discharge outlet is a minimum of 12” above the floor. Do not locate tap in any pit that is below the main floor level.

8.2.1.5 All piping systems, except natural gas, shall be tested at a minimum of one and one-half times the expected working pressure, or a minimum of 100 psig and a maximum of the design pressure of the pipe and fittings. Test all systems for a minimum of four hours. For natural gas, test at twice the working pressure or a minimum of 3 psig. When the test pressure exceeds 125 psig, the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50% of the specified minimum yield strength of the pipe.

8.2.1.6 All piping systems shall be installed with section valves at all branch connections.

8.2.1.7 All equipment, fixtures, or other appliances attached to any piping system shall have a shut off valve located at the connection to the piping system.

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8.2.1.8 All piping shall be labeled at intervals no greater than 20 feet on straight runs including risers and drops, adjacent to each valve fitting, and at each side of penetrations of structure or enclosure. All labeling shall comply with ANSI A13.1.

8.2.1.9 All valves shall be tagged with an engraved brass tag that describes the type of service and area controlled by the valve.

8.2.2 Domestic water systems

8.2.2.1 Materials

8.2.2.1.1 No PVC piping shall be used for domestic water systems.

8.2.2.1.2 All pipe and fittings, 3" and smaller, shall be copper, Type L, hard or soft drawn for solder joint connections, ASTM B88. All solder shall be lead-free. For pipe sizes larger than 3", galvanized pipe and fittings may be used.

8.2.2.1.3 Unions 2-1/2" and larger shall have flange joints.

8.2.2.1.4 Valves

8.2.2.1.4.1 Gate valves, 4" to 12", shall be flanged, cast iron, 125 lbs., solid wedge, bolted bonnet, OS&Y, Nibco F617-0 or equal. Gate valves smaller than 4" shall not be used.

8.2.2.1.4.2 Check valves 2" and smaller shall be soldered, bronze, 125 lbs., horizontal swing, Nibco S-413 or equal. Check valves 2-1/2" to 8" shall be flanged, cast iron, 125 lbs., bolted bonnet, horizontal swing, Nibco F-918 or equal.

8.2.2.1.4.3 Ball valves, 3" and smaller, shall be soldered, bronze 125 lbs., full port, Nibco S-580 or equal.

8.2.2.1.4.4 Butterfly valves, 6" and larger, shall be gear operated.

8.2.2.1.4.5 Globe valves shall be 2" and smaller. Globe valves 2" and smaller shall be threaded Nibco or equal.

8.2.2.1.4.6 Strainers, 2" and smaller, shall be threaded, bronze, 250 lbs., 20 mesh stainless steel screen, Watts Model 777 or equal. Strainers 2-1/2" to 12" shall be flanged, cast iron, 125 lbs., .045" perforated stainless steel screen, Hoffman Model 450 or equal. All closed loop systems should have strainers.

8.2.2.1.4.7 Low point drain valves shall be equipped with a hose adaptor fitting.

8.2.2.2 Hot water systems

8.2.2.2.1 Instantaneous, tankless water heating systems are preferred whenever feasible. All installations should be evaluated for the possibility of using this type of system.
8.2.2.2 All domestic hot water systems shall have recirculating pumps except in those systems that have the heating in close proximity to the use. Close proximity is considered to require less than 50' of piping between the heat source and the farthest outlet on the system. Where practical the recirculating pumps should be controlled by the building energy management system.

8.2.2.3 Recirculating pumps in hot water systems shall be constructed of non-ferrous material.

8.2.2.4 The desired temperature for hot water is a maximum of 120°F at the point of usage for normal faucet applications. Other types of usage may require other temperatures (dishwashers, cage washers, etc.) and should be evaluated individually. Where temperatures higher than 120°F are required at certain outlets for a particular intended use, separate heaters or booster heaters shall be installed for those outlets. *A DDC control temp setpoint of ___°F is required.*

8.2.2.5 Expansion tanks

8.2.2.5.1 All water systems that have backflow preventers shall be designed and installed with provisions for thermal expansion.

8.2.2.5.2 Each system shall be evaluated for the most efficient and cost effective method of providing for expansion.

8.2.2.5.3 Allowing the pressure relief valve to dump excess water due to expansion is not acceptable.

8.2.2.5.4 All expansion tanks shall be installed with provisions for draining and venting, and shall have a sight glass. Bladder tanks will require similar provisions as possible for the bladder type.

8.2.3 Water softeners

8.2.3.1 Water softening is required on all hot water systems. Other water shall not be softened except for specific applications that require softened water.

8.2.3.2 Specifications for water softening equipment should be based on Water Rite.

8.2.3.3 All water softening equipment shall be installed with a test port immediately downstream from the softening equipment.

8.2.3.4 Water softening systems should be designed to supply water at less than 1 grain of hardness. The water supply on the KSU campus typically has 13.5 grains of hardness.

8.2.4 Electric water coolers

8.2.4.1 All electric water coolers shall be of the refrigerated type.

8.2.4.2 ADA guidelines shall be used in the selection and installation of all electric water coolers.
8.2.2.4.3 Locations of electric water coolers shall be noted on the electrical plans as well as plumbing and architectural plans. This is to prevent the problem of having a drinking fountain with no electricity, causing a problem with a change order.

8.2.2.5 Hose bibbs and wall hydrants

8.2.2.5.1 A hose connection shall be installed in each mechanical room. Maintenance workers often need a water source in mechanical rooms.

8.2.2.5.2 Hose connections shall be located on the exterior of each building. A minimum of one hose connection shall be installed on each side of the building. The preferred spacing for hose connections is one every 100’. (These are needed by Grounds.) Where feasible, hose connections should be installed within 15’ of the main entrance to the building. Vacuum breakers/backflow preventers are required at all connections.

8.2.2.5.3 All exterior hose connections shall be of the recessed socket type. This type will prevent use with a pair of pliers, which damages the faucet.

8.2.2.5.4 All wall hydrants shall have individual shutoff valves for repair work.

8.2.2.6 Backflow preventers

8.2.2.6.1 All domestic water systems shall have backflow prevention devices at the point of building entry. No metering devices, taps, or other fittings shall be located upstream of the backflow preventer. However, if a common supply serves both the domestic water system and the fire protection system, it is preferred that the two systems be split immediately upon entering the building. Install the backflow preventer for each system at this point. For a description of the backflow preventer for the fire protection system see items 8.4.1.8 and 8.4.1.9, Fire Protection Systems.

8.2.2.6.2 All backflow preventers shall be reduced pressure principle devices.

8.2.2.6.3 All backflow preventers shall be located and configured to allow ready accessibility for maintenance and testing. Minimum clearance is 24” in all directions.

8.2.2.6.4 No backflow preventers shall be located more than 4’ above floor level.

8.2.2.6.5 Pit installations of backflow preventers will not be allowed.

8.2.2.6.6 Drainage from backflow preventers must be possible by gravity only, either to a floor drain or to the surface of the ground. Drains should be sized for the size of backflow. The average 2” floor drain will take about 55 G.P.M.

8.2.2.6.7 All backflow prevention devices must be approved by the Kansas Department of Health and Environment. Watts type RPZ’s is the preferred device to match existing University testing equipment.
8.2.2.7 Insulation

8.2.2.7.1 All domestic water systems shall be insulated with fiberglass insulation.

8.2.2.7.2 Insulation on piping in plenum areas shall be plenum rated.

8.2.2.7.3 All insulation shall comply with ASHRAE 90.1.

8.2.3 Sanitary waste and vent

8.2.3.1 Materials

8.2.3.1.1 Pipe and fittings may be cast iron, DWV copper, or DWV Schedule 40 PVC. The copper and PVC may be used above grade only. The cast iron may be either hubbed or no-hub. All piping systems shall be designed for the intended use.

8.2.3.2 All sanitary waste systems shall be designed for a maximum of 140°F material. No material shall be dumped in any sanitary waste system that has a temperature of more than 140°F. In some cases this will require cooling units on waste discharge. A particular problem is autoclaves. This steam is often dumped into the sanitary waste system, causing many problems. If equipment such as a dishwasher is installed that may discharge at slightly higher temperatures, PVC piping may not be used until that discharge has cooled to 140°F or less.

8.2.3.3 Every piece of equipment that requires indirect waste (backflow preventers, ice machines, autoclaves, etc.) shall be served by a drain at that piece of equipment. More than one piece of equipment can be served by a drain provided the pieces of equipment are close to each other and the sizing of the drain provides adequate drainage for the equipment. The preferred method for supplying this drain is by use of a floor drain, but other types of drains are acceptable, depending on the individual situation. In no case shall the drainage be accomplished by installing piping across the floor to a central floor drain. Drain lines that are installed at floor level to a central floor drain cause trip hazards, clutter the mechanical rooms, and often overload the capacity of the floor drain.

8.2.3.4 Floor drains

8.2.3.4.1 All floor drains shall have a minimum pipe size of 2", a minimum strainer size of 6", and have a removable strainer.

8.2.3.4.2 Upon completion of the installation of the floor drain and the floor around it, each area shall be tested to ensure that water on the floor in the area served by the drain is able to reach the drain by the force of gravity alone. We often have floor drains that are too high or that have a ridge around them, making them useless.

8.2.3.4.3 All mechanical rooms shall have a minimum of one floor drain. More floor drains shall be installed as required to maintain a ratio of one floor drain for every 500 square feet of floor area. These floor drains are in addition to those drains required for equipment.

8.2.3.5 All drain piping for accessible sinks that could be touched by the public shall be insulated. This shall comply with the requirements of ADA. A unit found satisfactory by the University is made by Tru-Bro.
8.2.4 Storm sewer systems

8.2.4.1 Pipe and fittings may be cast iron or DWV Schedule 40 PVC.

8.2.4.2 All surface water shall be directed to a storm sewer system. In no case shall storm water be placed in a sanitary sewer system.

8.2.4.3 Surface discharge of storm water shall not be allowed.

8.2.4.4 All interior piping of storm water shall be insulated.

8.2.5 Special systems

8.2.5.1 Emergency showers and eyewashes

8.2.5.1.1 Floor drains shall not be installed in close proximity to emergency showers and eyewashes. The use of an emergency shower or eyewash implies that a caustic chemical or radioactive material is involved. It is considered better for cleanup purposes to not contaminate the building drainage piping.

8.2.5.1.2 All piping to emergency showers and eyewashes shall comply with ANSI Z358.1.

8.2.5.1.3 In all new construction, any situation requiring either an emergency shower or eyewash should have both installed. It is preferred that they be co-located.

8.2.5.1.4 All emergency showers shall have a local alarm to notify persons in the area that the shower is in use.

8.2.5.1.5 Designs for installations of emergency showers or eyewashes should consider the feasibility of providing an alarm connection to the building security system.

8.2.5.2 Acid waste

8.2.5.2.1 Pipe and fittings may be Duriron or glass. All materials must be rated and approved for acid waste use. Use of plastic pipe is strongly discouraged for use in any and all academic and research facilities.

8.2.5.3 Distilled and de-ionized water

8.2.5.3.1 Pipe and fittings shall be Schedule 80 PVC or other plastic piping systems designed specifically for this type of service.

8.2.5.4 Natural gas

8.2.5.4.1 Pipe and fittings shall be carbon steel, A53 Gr. B or A106 Gr. B, Schedule 40.

8.2.5.4.2 Valves 1” and smaller shall be ball valves, rated for the type of service.
8.2.5.4.3 All valves that are exposed to the outdoor elements shall be of steel body construction. No brass shall be used outdoors.

8.2.5.5 Compressed air and vacuum
8.2.5.5.1 Pipe and fittings shall be Type L or K copper.

8.2.6 Fixtures
8.2.6.1 All fixtures and related equipment shall be of commercial grade or better.
8.2.6.2 Custodian closets
8.2.6.2.1 Each custodian closet shall be supplied with a floor sink. The preferred size is 24" x 36" and the minimum size is 24" x 24". The sink shall be supplied with a stainless steel edge cap.
8.2.6.2.2 Splash plates shall be installed on the wall around the floor sink.
8.2.6.2.3 The faucet shall be equipped with a hose connection. Vacuum breakers/backflow preventers are required at all connections. Both hot and cold water shutoffs are required for faucets.
8.2.6.2.4 All custodial closets should be located by the restrooms for easy hookup of water supply and drains. These rooms must be large enough to store supplies and all custodial equipment needed for the type of cleaning that needs to be done.

8.2.6.3 Rest rooms
8.2.6.3.1 ADAAG guidelines shall be used in the design of rest rooms.
8.2.6.3.2 All fixtures (sinks, urinals, water closets, etc.) shall be white in color.
8.2.6.3.3 All fixture hardware (faucets, flush valves, etc.) shall be chrome color.
8.2.6.3.4 For typical campus applications, no pop-up drain stoppers shall be installed in sinks. In residence halls or other special applications, pop-up drain stoppers may be desirable. In those applications without pop-up drain stoppers, the faucets should be specified without provisions for stoppers, but shall include strainers. Stoppers are an additional item that may break and need maintenance, and they are not needed in most campus applications. A faucet designed for a stopper and installed without one leaves a hole in the faucet body.
8.2.6.3.5 All water flow control devices shall be of the water conserving type.
8.2.6.3.6 In new construction, all fixtures shall be wall-hung. In existing construction, wall-hung fixtures are preferred if feasible.
8.2.6.3.7 All water closets shall have check hinges.
8.2.6.3.8 On applications that have automatic faucets, the infrared proximity sensor type is preferred. Spring return valves on faucets are not acceptable.
8.2.6.3.9 All showers shall have anti-scald mixing valves.

8.2.6.3.10 All plumbing fixtures need individual shutoffs for repair work.

Section 8.3 Underground Piping Systems

8.3.1 General requirements

8.3.1.1 In locations where piping passes beneath roadways or driveways, the engineer shall evaluate the expected load and specify appropriate materials to carry the load.

8.3.1.2 All underground piping systems, except copper, shall have a #12 AWG wire attached to the pipe for a tracing wire. The wire shall be labeled and terminated in an accessible location.

8.3.1.3 All underground piping systems shall have a warning tape, with appropriate wording, buried 24" above the pipe.

8.3.1.4 All underground piping systems that are installed using boring methodology shall have a warning system installed above the pipe. Review details of warning system intended for use before completing specification with University Facilities Planning staff.

8.3.1.5 Using a standard proctor at optimum moisture content (2%), all backfill shall be mechanically compacted to a minimum of 88% and a maximum of 92% of maximum density under landscaped areas and a minimum of 95% of maximum density under other areas.

8.3.2 Sanitary sewer

8.3.2.1 Cast iron systems

8.3.2.1.1 Pipe and fittings, all sizes, shall be cast iron, service weight, bell and plain end spigot, ASTM A 74. No-hub type piping can be considered for use after consultation with University Facilities Planning staff.

8.3.2.1.2 Joints, all sizes, shall be rubber gasket, push-on type, ANSI ASTM C 564.

8.3.2.2 PVC Systems

8.3.2.2.1 All piping shall be a minimum of Schedule 40.

8.3.2.2.2 All fittings shall be DWV.

8.3.2.2.3 PVC systems shall be protected by bedding material 6" above and on each side and 3" below the pipe. The bedding material may be sand, rolled stone, or other appropriate material that has no rocks larger than 3/4".

8.3.2.2.4 PVC shall not be used beneath buildings.

8.3.2.3 Clean outs
8.3.2.3.1  All clean outs shall be located in non-traffic areas.

8.3.2.3.2  Clean outs shall be installed in a concrete surround that is a minimum of 12" x 12" and 4" thick.

8.3.2.3.3  All clean out plugs shall be cast bronze with a hex head.

8.3.2.4  Testing

8.3.2.4.1  All sanitary sewer systems shall be tested with 10' of head pressure for not less than four hours.

8.3.3 Storm sewer systems

8.3.3.1  PVC piping may be used on storm sewer systems. For pipe sizes 8" and less, Schedule 40 shall be the minimum pipe used. For pipe sizes greater than 8", SDR 35 piping may be used. All fittings shall be DWV.

8.3.3.2  Cast iron pipe may be used. The same standards apply as for sanitary sewer above.

8.3.3.3  Concrete pipe and corrugated metal pipe may be used.

8.3.3.4  Clean outs

8.3.3.4.1  All clean outs shall be located in non-traffic areas.

8.3.3.4.2  Clean outs shall be installed in a concrete surround that is a minimum of 12" x 12" and 4” thick.

8.3.3.4.3  All clean out plugs shall be cast bronze with a hex head.

8.3.4 Water distribution systems

8.3.4.1  All piping systems shall comply with AWWA standards.

8.3.4.2  All water piping shall have a minimum of 32" of cover.

8.3.4.3  All water meters shall be located inside buildings. See item 8.2.1.3 for more information about water meters.

8.3.4.4  Valves shall be installed with cast iron valve boxes, set in concrete surround that is a minimum of 12" x 12" x 4" thick. The cover to the valve box shall be marked “Water.”

8.3.4.5  The preferred material for water distribution systems is PVC.

8.3.4.6  PVC systems

8.3.4.6.1  All PVC piping shall be C900 installed according to AWWA M23.

8.3.4.6.2  All fittings shall be ductile iron encased in polypropylene.

8.3.4.6.3  All fittings shall be installed with UL listed and approved retainers. Thrust blocks are required.
8.3.4.6.4 Valves shall be ductile iron, with resilient seats and bronze gates, which conform to AWWA C509. No split (2 piece) gates shall be allowed.

8.3.4.7 Copper systems

8.3.4.7.1 Copper shall only be used on pipe sizes 3" and smaller, and shall be used for building service only.

8.3.4.7.2 All copper pipe shall be Type K, ASTM B88, installed per AWWA C800.

8.3.4.7.3 Fittings shall be ANSI B16.22 wrought copper.

8.3.4.7.4 Valves, 2" and larger, shall be ductile iron, flanged, with key head and dielectric isolation. All bolts shall be stainless steel. Valves, 2" and smaller, shall be a key operated stop.

8.3.4.8 All water systems shall be hydrostatically tested at 1.2 times the expected working pressure, or 100 psig, whichever is greater, for a minimum of 4 hours.

8.3.4.9 The water piping systems shall be cleaned according to AWWA M23.

Section 8.4 Fire Protection Systems

8.4.1 Sprinkler systems

8.4.1.1 All test valves shall be located in mechanical rooms in central locations. A minimum number of locations shall be used for test valves. In new construction it is preferred that all test valves be at one location.

8.4.1.2 A pressure gauge shall be installed on the main supply of each sprinkler system, upstream from the main test valve. This is to monitor the pressure drop during operation of the main test valve.

8.4.1.3 Drainage shall be provided for all test locations that are sufficient to carry the full flow of water that can be expected during testing of the systems. This is particularly important at the location for testing the main drain of a system. Directing test water to the exterior of the building is not acceptable.

8.4.1.4 All valves shall be located with sufficient room for maintenance or replacement.

8.4.1.5 All sprinkler systems shall have a fire alarm panel installed that is capable of monitoring and reporting flow in all zones and tampering with all valves of the system. The panel shall be equipped for sounding a local alarm and shall be capable of interface with the campus security system. If the campus security system is in place in the building, the fire alarm panel shall be connected to that system. Contractor shall be responsible for marking the location of all fire alarm panels on as-built plans before submitting as-built's to the owner's representative.

8.4.1.6 Materials

8.4.1.6.1 All materials shall comply with NFPA.
8.4.1.6.2 If mechanical joint systems are used, the fittings shall be equal to Victaulic 005 Firelock Rigid. No cut grooves shall be allowed.

8.4.1.6.3 All underground piping shall be C900 with ductile iron fittings. The fittings shall be coated and wrapped with polyethylene per AWWA C105.

8.4.1.7 Testing

8.4.1.7.1 All sprinkler systems shall be tested at no less than 200 psig for no less than four hours.

8.4.1.8 All sprinkler systems shall have a RPZ type backflow preventer installed at the point of building entry. Sprinkler systems should not have double-check type back flow preventers.

8.4.1.9 Where a sprinkler system is to be installed in a non-heated area, it is preferred that a dry pipe system be installed rather than a chemical system. (If using a chemical system the AN RPZ backflow preventer must be used.)

Section 8.5 Refrigerant Cooling Systems

8.5.1 General design guidelines

8.5.1.1 All refrigerant systems shall comply with ASHRAE 90 and KSU Facilities Planning and utility systems Energy Conservation Policies (Appendix 2).

8.5.1.2 Design of cooling systems should avoid operating refrigerant systems when the outside air is less than 55°F.

8.5.1.3 All mechanical room installations shall comply with ASHRAE 15.

8.5.1.4 Wastewater cooled units are not acceptable.

8.5.1.5 All condensing units shall be designed to 105°F outside air temperature.

8.5.1.6 Consideration shall be given to accessibility for service when locating all equipment.

8.5.2 Material

8.5.2.1 All piping and fittings shall be copper except in an evaporative condenser, where steel piping is acceptable. Long radius fittings are preferred for HVAC systems where space allows and are required for refrigerant systems.

8.5.2.2 All valves shall be full port. Provide isolation valves on each side of driers. The designer shall evaluate the need for check valves on the discharge of compressors, especially when the condenser is higher than the compressor. The discharge from all relief valves shall be piped to the exterior of the building. Documentation of the amount of refrigerant a system contains is required in the as-builts.

8.5.2.3 All solder shall be 15% silver solder except on connections to expansion valves, sight glasses, and driers where “Stabrite” solder is acceptable.
8.5.2.4 Insulate suction and hot gas bypass in all locations and discharge lines if exposed in occupied areas. For units above 5 tons, use 1" fiberglass insulation. For smaller units, use \( \Box \) closed cell foam insulation, minimum. All insulation shall comply with ASHRAE 90.1. All insulation on exterior piping shall be protected by an aluminum jacket.

8.5.2.5 Label all lines at all access points and every 20' of exposed piping with the type of refrigerant contained in the lines.

8.5.3 Equipment

8.5.3.1 All equipment shall be mounted on isolation pads.

8.5.3.2 Compressors

8.5.3.2.1 All compressors shall be supplied with a 5-year warranty.

8.5.3.2.2 Multiple units are preferred over larger single units.

8.5.3.2.3 All compressors shall be single speed.

8.5.3.2.4 All 3-phase units shall have adjustable voltage monitors for each phase, with manual reset.

8.5.3.2.5 Provide recycle timers and crankcase heaters with all compressors.

8.5.3.2.6 Provide driers on all liquid lines with isolation valves on each side of the drier.

8.5.3.3 All solenoid valves shall have a manual lift stem.

8.5.3.4 Provide driers on all liquid lines with isolation valves on each side of the drier.

8.5.3.5 Condensing units, if designed to operate at less than 55\(^\circ\)F, shall be provided with hot gas bypass and with condenser fan cycle control operated from the head pressure. Outside air dampers are proffered for free cooling.

8.5.3.6 All coils shall have copper tubes and aluminum plate fins.

**Section 8.6 Water Cooling Systems**

8.6.1 General Requirements

8.6.1.1 All new chilled water systems shall be Primary/Secondary systems with 2-way control valves. The designer may consider variable speed pumps for secondary systems.

8.6.1.2 During the design of all cooling systems, the designer shall evaluate the current and proposed chilled water loops.

8.6.1.3 Piping at HVAC units shall not obstruct filter access panels.

8.6.2 Chilled Water Loops

8.6.2.1 All chilled water loops shall be two-pipe systems.
8.6.2.2 Material for chilled water loops shall be PVC C900, class 150 piping only, with ductile iron fittings. Insulation will be provided if economically justified. Insulation shall be provided where chilled water lines pass close to steam lines.

8.6.2.3 All fittings shall be installed with UL listed and approved retainers. Thrust blocks shall be provided.

8.6.2.4 All underground piping shall have a minimum earth cover of 36" to the top of the pipe.

8.6.2.5 All underground piping systems shall have a #12 AWG copper wire attached to the pipe for a tracing wire. The wire shall be labeled and terminated in an accessible location.

8.6.2.6 All underground piping systems shall have a warning tape, with appropriate wording, buried 24" above the pipe.

8.6.2.7 Isolation valves shall be installed for each building service. The isolation valve shall be a gate valve, installed with a valve box, located as close as practical to the main line. Gear-operated butterfly valves may be considered on a case by case basis.

8.6.2.8 All loop systems shall be provided with a means of air relief at all high points. The preferred method for air relief is a manually operated ball valve located underground in a meter box or similar enclosure.

8.6.2.9 All building service piping shall have a strainer and side-arm filter installed at the point of entry into the building.

8.6.3 Interior Chilled Water Systems

8.6.3.1 Piping

  8.6.3.1.1 PVC shall not be used for chilled water systems above ground.

  8.6.3.1.2 Welded steel systems shall use black steel piping and fittings, ASTM A120, Schedule 40. The minimum pipe size shall be 3/4".

  8.6.3.1.3 Copper systems shall use a minimum of Type L copper. The solder shall be lead-free.

8.6.3.2 Valves

  8.6.3.2.1 Control valves, for pipe sizes 3" and smaller, shall be globe valves. For pipe sizes larger than 3", the control valves shall be butterfly valves.

  8.6.3.2.2 Isolation valves, for pipe sizes 2" and smaller, shall be ball valves. For pipe sizes larger than 2", the isolation valves shall be butterfly valves.

  8.6.3.2.3 Balancing valves 2-1/2" and smaller shall be plug valves. For pipe sizes larger than 2-1/2", butterfly valves shall be used.
8.6.3.2.4 Butterfly valves shall be resilient seated with bronze or stainless steel discs and shall be bubble-tight. All butterfly valves shall be lug-type and gear operated.

8.6.3.3 Insulation

8.6.3.3.1 All insulation shall comply with ASHRAE 90.

8.6.3.3.2 All insulation shall be fiberglass, flexible unicellular foam, or cellular glass.

8.6.3.3.3 All exterior, exposed piping shall have an aluminum jacket installed to protect the insulation. The jacket shall be weather-resistant, waterproof, smooth surfaced aluminum with a minimum thickness of 0.016”.

8.6.3.3.4 All interior piping that is exposed in occupied areas and is within 6' of the finished floor shall have a PVC jacket installed. This jacket shall be painted to match the surrounding background.

8.6.3.3.5 All interior piping that is exposed in mechanical rooms, and is within 6' of the finished floor, shall have an aluminum jacket installed.

8.6.3.3.6 All penetrations through fire walls, or floor or roof decks shall have fire-stopping material installed at the penetrations.

8.6.3.4 Hanger design, application, and installation shall comply with MSS SP-58 and SP-69.

8.6.3.5 All chilled water systems that are not part of campus loop shall have a fill and make-up connection installed. A backflow preventer shall be installed at each connection. It is preferred that the connection be sized to allow the filling of the system in approximately 4 hours. However, the size should be evaluated in relation to the cost of the backflow preventer.

8.6.3.6 All chilled water systems shall have an air separator installed.

8.6.4 Condenser Water Systems

8.6.4.1 The designer shall evaluate the cost/benefit of using PVC, FRP or stainless steel piping instead of steel piping. It is preferred that steel piping not be used. If PVC is used, it shall be Schedule 80. If stainless steel is used, it shall be Schedule 10.

8.6.5 Equipment

8.6.5.1 The selection of all equipment shall comply with the KSU Energy Conservation Policy #030 located in Appendix 2.

8.6.5.2 All motors shall be high efficiency and meet the KSU Energy Conservation Policy #060 located in Appendix 2.

8.6.5.3 All equipment shall be mounted on isolation pads.

8.6.5.4 Cooling Towers
8.6.5.4.1 The minimum standard of quality is a fiberglass structure with stainless steel fittings and PVC fill. The designer shall evaluate the cost/benefit of using a wood or stainless steel tower for each installation.

8.6.5.4.2 Consideration shall be given to the aesthetic qualities of any towers located in the view of the public. A screen or other method of removing the tower from view may be appropriate in some situations.

8.6.5.4.3 If year-round operation is desired, a dry-basin type tower is preferred over sump heaters. An indoor sump is preferred to outdoor types.

8.6.5.4.4 Gravity flow distribution systems are preferred.

8.6.5.4.5 All hot water basins shall have easily removable covers.

8.6.5.4.6 A five-year warranty shall be provided with each cooling tower.

8.6.5.4.7 All cooling towers must have CTI certified performance.

8.6.5.4.8 All fans shall be gear/shaft driven with the motor located outside the air stream. No belt-driven fans shall be allowed. The designer shall evaluate the use of 2-speed or variable speed fans. All variable frequency drives shall be installed with a bypass switch.

8.6.5.4.9 All cooling towers shall have extended lubrication lines.

8.6.5.4.10 All cooling towers shall have vortex breakers installed on cold water sumps.

8.6.5.4.11 The designer shall evaluate the cost/benefit of aluminum or fiberglass support systems over coated steel.

8.6.5.4.12 Roof-mounted cooling towers that are elevated above the surrounding grade shall have deck installed around the perimeter of the tower.

8.6.5.5 Chillers

8.6.5.5.1 The type of chiller to install shall be determined by Facilities Planning and Facilities Management, for chillers larger than 100 tons.

8.6.5.5.2 The designer shall consider efficiency losses over time when sizing the cooling tower for a chiller.

8.6.5.5.3 Chiller controls shall be digital type controls. For systems larger than 100 tons, controls shall be integrated with the building EMS. A hand-off-auto switch shall be provided to allow local control or EMS control. All control panels shall be provided with interface capabilities for connection to the EMS for demand control and chilled water reset.

8.6.5.5.4 Provide thermometers and pressure gauges for the entering and leaving condenser and chilled water and the bypass lines. The thermometers shall be 6" dial type. Mercury thermometers are not allowed in this application. (See also 8.2.1.2.1).
8.6.5.5  Provide hour meters on electric chillers.

8.6.5.6  Provide flow meter/switch combinations on chilled water, condenser water, and steam lines.

8.6.5.7  Consideration shall be given to sound attenuation when designing the location and installation of a chiller.

8.6.5.8  Condensate coolers shall be used on absorption chillers.

8.6.5.9  All pipe connections to chillers shall be flanged.

8.6.5.10  All cold sections and lines shall be insulated.

8.6.5.11  All chillers shall be installed on housekeeping pads that are a minimum of 4" in height.

8.6.5.6  Pumps

8.6.5.6.1  All pumps shall have mechanical seals. Pumps that are 7 horsepower and greater shall have mechanical split seals. A standard of quality for mechanical split seals is Bell & Gossett.

8.6.5.7  Expansion Tanks

8.6.5.7.1  All expansion tanks shall be located on the suction side of pumps and shall be diaphragm type.

8.6.5.8  All condensing water systems shall have stainless steel strainers installed.

8.6.5.9  Controls

8.6.5.9.1  All equipment shall have a hand/off/auto switch installed to allow manual override of the normal controls.

8.6.5.9.2  Chiller controls shall be digital and shall include the capability to interface with the Energy Management Control System for chilled water reset, demand limiting, and remote start/stop.

8.6.5.10  Water Treatment

8.6.5.10.1  The designer shall coordinate the design of the water treatment system with KSU Facilities utility systems.

Section 8.7  Steam and Hot Water HVAC Systems

8.7.1 Distribution (Steam)

8.7.1.1  Direct buried systems are not allowed. All distribution piping shall be installed in a steam chase.

8.7.1.2  Pipe and fittings

8.7.1.2.1  All piping shall be black steel. Supply piping 2" and smaller shall be Schedule 80. Supply piping larger than 2" shall be Schedule 40.
8.7.1.2.2  Fittings 2” and smaller shall be threaded only for appendages. Fittings for general piping shall be welded. Fittings 3” and larger shall be welded, with flanged connections to valves and equipment. All fittings shall be forged steel. Piping at HVAC units shall not obstruct filter access panels.

8.7.1.3  Valves 2” and smaller shall be threaded OS&Y gate valves, 800 lbs. class. Valves 3” and larger shall be flanged, cast steel, OS&Y, properly rated for operating pressure, at 550°F.

8.7.1.4  Strainers shall be forged bodied of 300 lbs. class.

8.7.1.5  Traps shall be cast iron bodied of 250 lbs. class. A cooling/storage chamber shall be installed with each trap. The KSU Facilities utility systems will supply a design for the chamber.

8.7.1.6  Pipe guides for 4” and smaller shall be axial, full circumference, “spider” type. For larger sizes, "T"-style slides shall be used.

8.7.1.7  All anchors shall be fully welded to the pipe and shall be located in manholes or other accessible spaces whenever possible.

8.7.1.8  All anchors, guides, and other metal accessories shall be constructed of painted metal, and shall not be mounted on the floor of manholes or chases. All support systems shall be wall mounted.

8.7.1.9  All drip legs shall be a minimum of 12” above the floor.

8.7.1.10  All items that require maintenance shall be located to allow ease of access.

8.7.1.11  The designer shall evaluate the cost/benefit of using expansion joints or expansion loops on a life cycle basis. If a leak occurs plug pac type joints can be repaired while in operation, eliminating down time. If you don’t pac them, they don’t work.

8.7.1.12  All condensate mains shall have float-type automatic air vents, 250 lbs. class, located at the high points of the system. All air vents shall be easily accessible.

8.7.1.13  Insulation

8.7.1.13.1  All steam and condensate lines shall be insulated to meet KSU Energy Conservation Policy #020 located in Appendix 2, and ASHRAE 90.1

8.7.1.13.2  Owens-Corning Fiberglass shall be used as a standard of quality.

8.7.1.13.3  Jackets of .020” smooth surfaced aluminum shall be installed in accessible areas. Insulation in non-accessible areas shall not have a jacket installed.

8.7.1.14  Steam Chases

8.7.1.14.1  Steam chases shall be constructed of “U” channel, reinforced concrete. Weatherproofing shall be provided between sections of the chase.

8.7.1.14.2  The floor of the chase shall have a continuous drain trough that is a minimum of 2” deep and 6” wide. The chase shall be graded to provide drainage of this trough to the manholes. Nothing shall be allowed to

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obstruct this drain trough.

8.7.1.14.3 The lid for steam chases shall be pre-cast, reinforced concrete, that is notched over the $\square$ channel walls to prevent movement. Lifting eyes or lugs shall be provided. Weatherproofing shall be installed at the joints between the lid and the chase walls and between the adjoining lids. A weatherproofing system over the top of the chase shall be installed.

8.7.1.14.4 Soil compaction beneath steam chases shall be a minimum of 95% of maximum density at optimum moisture content (+ 2%), standard proctor. Excavation to undisturbed soil is not considered sufficient. Compaction to the sides and above a chase is dependent on the area. If the chase is passing beneath a paved area, the above conditions shall apply. If the chase is passing beneath a landscaped area, the soil shall be compacted to 88-92% of maximum density.

8.7.1.14.5 All supports shall be wall mounted. Nothing shall be supported from the floor of the chase.

8.7.1.14.6 When a steam chase crosses another utility line, a minimum clearance of 6" shall be maintained and a minimum of 2" of insulation shall be installed between the chase and the other utility.

8.7.1.14.7 When a steam chase is routed through landscaped areas, the top of the chase shall be a minimum of 3' beneath the surface. The designer shall evaluate the need for insulation to protect plantings.

8.7.1.15 Manholes

8.7.1.15.1 All manholes shall be constructed of reinforced concrete.

8.7.1.15.2 All penetrations shall be sealed.

8.7.1.15.3 All manholes shall have a sump with a minimum size of 2' x 2' x 2'. Gravity drainage of the sump is preferred. French or siphon drains are not allowed.

8.7.1.15.4 A pump shall be installed where gravity drainage of the sump is not possible. The pump will be supplied by the plumbing shop and installed by the contractor. A dedicated electrical circuit shall be provided for the pump. Discharge piping shall be copper and shall include a check valve, union, and a shut-off valve. Pumps shall be rated for high temperature liquids.

8.7.1.15.5 Where electricity is supplied to a manhole, a separate circuit with a waterproof GFI duplex receptacle shall be installed for maintenance. All electrical wiring shall be installed in rigid conduit.

8.7.1.15.6 One piece ladders shall be used. Individual rungs mounted or cast to the wall are not acceptable. All ladders shall be welded carbon steel that is hot dipped galvanized. Rungs shall be non-slip, 3/4" diameter on 12" centers.

8.7.1.15.7 Manhole lids shall be sized for any equipment in the manhole, but shall be no smaller than 32" in diameter. The lid shall not be fastened. All manhole covers and frames shall be cast iron. A standard of quality is the Neenah R-6080 with solid cover. All covers shall be imprinted with the
8.7.1.15.8 A vent hole with a solid lid shall be provided in each manhole. The minimum size is 12" in diameter. All vent covers and frames shall be cast iron. A standard of quality is the Neenah R-6007 with type F underside hooks for locking.

8.7.2 Medium and Low Pressure Steam (Above Grade)

8.7.2.1 Medium pressure steam is defined as being 15-90 psig. Low pressure steam is below 15 psig.

8.7.2.2 All drawings shall show drip legs and the specifications shall require drip legs for all risers.

8.7.2.3 Pressure Reducing Valves (PRV)

8.7.2.3.1 Leslie is the preferred brand of valve and shall be used as a standard of quality. Other acceptable brands are Spence, Masoneilan, Dunham/Bush and Spirax/Sarco.

8.7.2.3.2 All PRV’s shall be installed with isolation valves, a bypass loop with a globe valve in the bypass, and pressure gauges on both sides of the PRV. All PRV's shall be located and configured to allow ready accessibility for maintenance. Whenever possible, provide a minimum clearance of 24" in all directions. No PRV shall be located more than 8’ above floor level. The designer shall evaluate the feasibility of using wall-mounted PRV’s.

8.7.2.4 Pipe and Fittings

8.7.2.4.1 All piping shall be black steel. For supply, the piping shall be Schedule 40. For condensate, the piping shall be Schedule 80. No malleable iron is allowed on steam or condensate lines. FRP is acceptable for remote condensate.

8.7.2.4.2 Fittings 2" and smaller shall be threaded cast iron or iron. Fittings 2" and larger shall be welded, with flanged connections to valves and equipment.

8.7.2.4.3 Piping at HVAC units shall not obstruct filter access panels.

8.7.2.5 Valves 2" and smaller shall be 150 lbs. Rising stem gate valves with a union on one side. Valves 2" and larger shall be OS&Y gate valves. Globe valves shall be used only for throttling purposes. Globe valves shall be a minimum of 150 lbs., and shall be rated for steam. Value trim shall match steam temperature. Do not assume saturation temperature.

8.7.2.6 All traps shall be protected by a strainer upstream. Isolation valves shall be installed on each side of each trap. No integral check valves shall be used. Armstrong traps should be used as a standard of quality.

8.7.2.7 Strainers shall by Y-pattern, rated for steam, with stainless steel baskets. All strainers shall be installed with a blow down valve.
8.7.2.8 Safety relief valves shall have piping that is equal to or larger than the tappings of the valve. The discharge shall be piped to a safe point. It is preferred that the discharge be piped to the exterior of the building. Provide flanged or union connections for replacement.

8.7.2.9 All pipe shall be insulated to meet ASHRAE 90.1 and the KSU Energy Conservation Policy #020 located in Appendix 2. Closed cell foam insulation shall not be used.

8.7.2.10 All piping that is exposed in occupied areas, and is within 8’ of the finished floor, shall have a jacket installed. PVC shall not be used for this jacket.

8.7.2.11 Heat exchangers shall be ASME approved and shall be installed with relief valves, rated for the service, on both the steam and hot water systems. Locate heat exchangers to allow removal of the bundle. Drawings shall clearly show the reserved pulling space to allow removal of the bundle. Install gauges and thermometers to indicate the following: Pressure of the entering steam, pressure and temperature of the entering water, and pressure and temperature of the leaving water. Install diaphragm expansion tanks on the water side of all heat exchangers. All heat exchangers require individual shutoffs for repair work.

8.7.2.12 All coils shall be tube-in-tube, non-freezing type with a minimum 1” O.D. tubing. The designer shall consider the use of integral face and bypass coils, especially in situations using steam to pre-heat outside air. Provide two steam traps with bypass for all pre-heat coils.

8.7.2.13 Steam humidifiers shall be equipped with normally closed controls to automatically shut off the steam supply during the cooling season.

8.7.2.14 Air vents/vacuum breakers shall be installed on steam equipment as required.

8.7.3 Hot Water

8.7.3.1 Pipe and fittings may be either black steel or copper. Steel should be as described at 8.7.2.4. Copper shall be Type L and shall be 3” or smaller.

8.7.3.2 All hot water piping shall be insulated to meet ASHRAE 90.1 and KSU Energy Policy #020 located in Appendix 2.

8.7.3.3 All piping that is exposed in occupied areas, and is within 8’ of the finished floor, shall have a jacket installed.

8.7.3.3.1 Piping at HVAC units shall not obstruct filter access panels.

8.7.3.4 Pumps

8.7.3.4.1 All pumps shall be installed in easily accessible locations and shall have isolation valves installed on each side of the pump.

8.7.3.4.2 Bell & Gossett shall be used as the standard of quality.

8.7.3.4.3 All pumps shall have mechanical seals.

8.7.3.4.4 Horizontal in-line pumps shall have a maximum of 1 horsepower. Vertical in-line pumps shall have a maximum of 5 horsepower, be
mounted within 4' of the floor, and shall be protected by a strainer. It is preferred that all in-line pumps be close-coupled.

8.7.3.4.5 Base-mounted, centrifugal pumps shall be installed with a pressure gauge manifold and a suction diffuser/strainer. The use of triple duty valves is preferred. Pipe vibration isolators shall be stainless steel. The designer shall evaluate the need for vibration isolation on the pump.

8.7.3.5 Air Venting

8.7.3.5.1 Automatic air vents are not preferred. If used, they must be readily accessible.

8.7.3.5.2 Hose bibbs shall be installed for manual air vents at all high points of the hot water systems.

8.7.3.5.3 Air separators are required on all systems. Centrifugal-type air separators are preferred.

8.7.3.6 Coils

8.7.3.6.1 All coils shall have a minimum of .025" tube wall thickness and 5/8" O.D. minimum diameter.

8.7.3.6.2 It is preferred that hot water only coils have a maximum of 8 fins/inch.

8.7.3.6.3 All coils shall have copper coils, aluminum fins, and non-ferrous headers.

Section 8.8 Air Handling Systems

8.8.1 General requirements

8.8.1.1 Design of air handling systems shall comply with ASHRAE 90.1 and KSU Energy Conservation Policies located in Appendix 2. Equipment shall be limited to the fewest number of components practical. Variable Air Volume (VAV) systems are preferred.

8.8.1.2 Economizer cycles are preferred. If an economizer cycle is used, and the size of the equipment dictates, a return air fan is suggested to prevent over pressurization of the conditioned space. Freezestats must be installed with all economizer cycles.

8.8.1.3 All systems that use 100% outside air should be evaluated for the use of heat recovery systems and/or outside air for free cooling whenever possible.

8.8.1.4 All designers shall consider noise and ease of maintenance when locating equipment.

8.8.1.5 A drawing shall be mounted near the air handling unit showing the as-built locations of all fire dampers, balancing dampers, VAV boxes, coils, and other equipment in the ductwork served by that unit. The drawing shall be protected by glass or other suitable material.
8.8.1.6 The location of outside air intakes shall be carefully considered to prevent intake of exhaust from other systems equipment or delivery vehicles.

8.8.1.7 Piping at HVAC units shall not obstruct filter access panels.

8.8.1.8 It is preferred that no HVAC units are to be located in classrooms or where you have to place scaffolding or use extension ladder to get to the equipment.

8.8.2 Comfort Systems

8.8.2.1 Air Handling Units

8.8.2.1.1 For new construction (and existing buildings where possible), locate all air handling units inside the building or in a penthouse. Rooftop and above ceiling locations are not preferred. Variable air volume (VAV) boxes should be located in corridors or other common areas whenever possible.

8.8.2.1.2 All units shall provide thorough mixing of outside and return air. Blowthrough units are preferred over draw-through units. The designer shall evaluate the need for engineered mixing boxes, blenders, or other methods to prevent stratification of the air.

8.8.2.1.3 Hinged access doors shall be provided on all units to provide access to filters, coils, fans, dampers, etc. Door handles shall be used on these doors. Bolted panels are not acceptable except on very small units.

8.8.2.1.4 All drain pans shall be insulated and bottom drained. Provisions for cleaning shall include either a removable pan or ease of access for cleaning in place. Traps for drain systems shall be sized for the system served. Ensure adequate room for the size of trap required. Adjust the height of the housekeeping pad as required. However, 6" is the preferred minimum height for housekeeping pads.

8.8.2.1.5 All units shall have a manometer-type filter pressure differential indicator installed with a manifold and valves to isolate the lines to each side of the filter. Units sized under 10 tons do not need to have this indicator.

8.8.2.1.6 Thermometers shall be installed to show the temperatures of the mixed, discharge, outside, and return air. Thermometers shall be bi-metal type with a minimum dial face of 6". Units sized under 10 tons do not need to have this indicator.

8.8.2.1.7 All oil and grease lines shall be extended to the exterior of the case.

8.8.2.2 Filters shall comply with ASHRAE Systems and Equipment Handbook, Chapter 25, Table 2.

8.8.2.3 Dampers

8.8.2.3.1 All dampers that will be used in a fully closed position shall be low-leakage type. A standard of quality is Ruskin CD60.
8.8.2.3.2 Maximum leakage for all duct systems is 5%. To be verified by independent testing and balancing after contractor has provided a rough balanced system.

8.8.2.3.3 All branch duct takeoffs shall use the 45 degree design and shall have a balancing damper installed in each branch as close to the main duct as practical. No splitter dampers or air extractors shall be used.

8.8.2.3.4 Insulation shall comply with ASHRAE 90.1. Only external insulation shall be used. In mechanical rooms or other places where ductwork is exposed, rigid fiberglass insulation shall be used. The rigid fiberglass insulation shall be a minimum of 2” thick and shall be glued and pinned.

8.8.2.3.5 Flexible ductwork shall have a maximum length of 6’ and shall be properly supported. Flexible ductwork shall only be used for connecting the branch duct to the diffuser. In no case shall flexible ductwork be used upstream of VAV boxes.

8.8.2.3.6 Outside air-cooling will be used whenever possible.

8.8.2.4 Diffusers

8.8.2.4.1 Diffusers with integral dampers shall not be used. System balance dampers shall be installed upstream of diffusers.

8.8.2.4.2 Perforated diffusers are acceptable for use.

8.8.2.4.3 System balance dampers shall be installed upstream of diffusers.

8.8.2.4.4 In a suspended ceiling installation, it is preferred that diffusers use a 24” x 24” mounting plate. A small diffuser mounted in a large ceiling tile is not preferred.

8.8.2.4.5 Diffusers for VAV systems shall be specified with consideration given to air dumping at low velocities.

8.8.2.4.6 Duct is to be in line with diffuser of ductline (no off sets).

8.8.2.5 All turning vanes shall be airfoil type. Single or double vane is acceptable based upon application.

8.8.2.6 Variable air volume controllers should be specified with high quality and long-term usage in mind.

8.8.3 Fume Hoods and Laboratory Systems

8.8.3.1 General Requirements

8.8.3.1.1 All fume hood systems shall be designed based on hazard designations from KSU Public Safety.

8.8.3.1.2 For all fume hood installations or alterations, the balance of make-up air to exhaust air for the affected zone or building shall be evaluated. Fume hoods that will cause or aggravate an imbalance between the make-up air and exhaust air shall not be installed unless the
imbalance is corrected. The preliminary design for a project may proceed on the basis of existing drawings and/or balance data. The final design must be based on actual test data.

8.8.3.3 All systems, whether new or replacement, shall be designed using variable air volume (VAV) hoods, VAV supply fans and constant volume exhaust fans. If the complete exhaust-supply system cannot be installed at the time of fume hood installation, this may require a constant velocity-type fume hood be installed. If so, select the fume hood for future modification to a VAV-type fume hood. Minor modifications to existing fume hoods that do not increase makeup air problems or cause other imbalances are exempt from this requirement.

8.8.3.4 A life-cycle economic analysis shall be performed for every fume hood installation. Factors for the analysis shall include, but not be limited to, initial cost of installation, projected energy costs, and projected maintenance costs. Analysis shall give the present worth of the system based on 15 years operation with annual costs listed.

8.8.3.5 All fume hood systems shall be designed according to ANSI Z9.5 with the following exception: The design face velocity shall be consistent with 8.8.3.1.1.

8.8.3.6 All measurements performed to ensure compliance with the listed face velocities shall be performed with a velocity grid sensor. (KSU Public Safety owns one.)

8.8.3.7 Where feasible it is preferred that systems be grouped to use fewer pieces of equipment.

8.8.3.8 Fume hoods and supply air diffusers shall not be located so that a supply diffuser is in front of a fume hood.

8.8.3.9 Perchloric and radioactive systems shall be completely separate from other exhaust systems.

8.8.3.10 Provide manifold exhaust systems where possible. When manifold systems are used, use redundant, high plume Strobic fans.

8.8.3.2 Fume hoods

8.8.3.2.1 The standard of quality for fume hoods is Labconco. A state contract for fume hoods exists and is available for use on projects.

8.8.3.2.2 All fume hoods shall be equipped with a face velocity monitor and markings on the front of the hood indicating the maximum sash opening height and sash height for maximum air flow. A standard for quality is Phoenix Controls.

8.8.3.2.3 All fume hoods must be certified by KSU Public Safety before use.

8.8.3.2.4 All fume hoods shall have half-sash locks with alarms. The alarms may have a user override but, if the override is used, shall sound again after four minutes.
8.8.3.2.5 All fume hoods shall have flow indicators with low flow alarm.

8.8.3.2.6 Vertical sashes are preferred. The use of horizontal sashes is discouraged.

8.8.3.3 Ductwork

8.8.3.3.1 All fume hood and laboratory exhaust system ductwork shall be constructed with 304 stainless steel and shall be of riveted and sealed construction unless other materials are required by the uses of a particular system.

8.8.3.4 Controls

8.8.3.4.1 Control the fume hood exhaust, room exhaust, and room supply air flows with a variable air volume (VAV) scheme to maintain a constant fume hood face velocity of 100 FPM and to provide climate comfort control for the room occupants.

8.8.3.4.2 Control equipment shall be Phoenix or approved equal. Air flow control devices shall be Venturi type valves.

8.8.3.4.3 Any control system used shall have a response time of 1 second or less.

8.8.3.4.4 Use the sash position type of control design, not air pressure differential.

8.8.3.4.5 Use a proximity sensor to reduce the face velocity to 70-80 FPM when no one is in the immediate vicinity of the front of the fume hood.

8.8.4 Animal Quarters

8.8.4.1 Design parameters for animal quarters shall include 100% outside air, 100% exhaust, heat recovery on the exhaust air, and a 50% safety factor on the total heat load.

8.8.4.2 Verify the required space temperatures with the ultimate user of the space.

8.8.4.3 Where available, use steam for all preheat coils. Use a freeze-proof design on all coils.

8.8.5 Auditoriums

8.8.5.1 Design of air handling systems for auditoriums should consider the use of CO2 monitors and occupancy monitors to control the amount of outside air required.

8.8.5.2 Generally, it is preferred that auditorium systems be separate from other building systems.

8.8.5.3 Special consideration shall be given to noise problems in auditorium applications. Submit acoustic calculations for the mechanical equipment. Particular attention shall be given to low frequency vibrations.
Section 8.9  Control Systems

8.9.1 General requirements

8.9.1.1 All control systems shall comply with Energy Conservation Policy #040 located in Appendix 2.

8.9.1.2 All large systems, as defined by Energy Conservation Policy #040, shall be controlled by the university’s energy management control system (EMS). Small systems may be controlled by stand alone pneumatic or electronic systems. If electronic controls are used on small systems they must be 100% compatible with the university’s EMS.

8.9.1.3 Special consideration shall be given to noise problems in classroom or auditorium applications. Submit acoustic calculations for the mechanical equipment. Particular attention shall be given to low frequency vibrations.

8.9.1.4 The use of pneumatic actuators with electronic sensors and controls is preferred. If electric actuators are used, they shall be heavy-duty.

8.9.1.5 All safeties, including freeze-stats, smoke detectors, high static detectors, outside air Eps, etc. shall be hard wired in series with the motor controllers.

8.9.1.6 As much as practical, place controllers in a central, easily accessible location inside a protective cabinet. The designer shall evaluate the need for a cabinet for individual controllers.

8.9.1.7 For areas that have variable occupancy loads such as auditoriums, gymnasiums, classrooms, etc., consideration should be given to control of the outside air volume through the use of CO2 monitors.

8.9.1.8 Designer needs to make sure that the Contractor will be responsible for hardwiring to base line in the steam tunnel or back to Dykstra. All control will be connected to the DDC controls system at Dykstra Hall.

8.9.2 Equipment

8.9.2.1 Actuators

8.9.2.1.1 Pneumatic actuators are preferred.

8.9.2.1.2 The use of positioners is preferred.

8.9.2.1.3 For damper applications, use a minimum of one actuator for each 25 square feet of damper area.

8.9.2.1.4 For valve applications, size valves and actuators for full close and full open with a maximum of 18 pounds of air pressure.

8.9.2.1.5 Actuators for outside air dampers and pre-heat coils shall have a spring return.

8.9.2.2 Air compressors for control air shall be supplied with air filters, air dryers, and oil separators.

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8.9.2.3 Install gauges on all input and output control signal lines at the controller.

8.9.2.4 Sensors

8.9.2.4.1 All electronic temperature sensors shall be 1,000 ohm platinum, resistance temperature detectors (RTD's) with 2 wire connections. Install using thermo-conductive material in thermo wells.

8.9.2.4.2 If the application requires a humidity sensor, a high quality unit should be specified. Hy-cal can be used as a standard of quality.

8.9.2.4.3 Differential pressure switches, if used for fan status on VAV applications, shall not be Barber-Coleman PC301. All units used shall be repeatable, reliable, and adjustable.

8.9.2.4.4 Air flow stations shall be used to measure outside air on all systems. These stations shall be averaging grid type with 90% accuracy that comply with ASHRAE standards for duct traversing.

8.9.2.4.5 Freeze-stats shall be sized and configured to provide accurate averaging for the coil and shall have a manual reset.

8.9.3 All tubing shall be hard drawn copper except within 2’ of a device, where poly tubing may be used. All tubing shall be supported directly from the building structure with supports at a maximum of 6’ on center.

8.9.4 Sequence of Operation

8.9.4.1 The following sequences of operation are to show our preferred controls for a typical system. Where the designer determines that these are not appropriate for a specific design, these may be changed. However, every effort shall be made to comply with the intent of these arrangements.

8.9.4.2 100% outdoor air systems

8.9.4.2.1 Typical equipment list, in order from outside air intake to exhaust.

8.9.4.2.1.1 Supply air duct
- Outside air sensor
- Outside air damper, NC, 2 position.
- Filter rack
- Air flow monitor
- Heat recovery coil
- Heat recovery discharge air temperature sensor
- Steam pre-heat coil w/NO 2 position valve and NO modulating valve
- Supply fan
- Pre-heat coil discharge temperature sensor
- Freeze-stat, manual reset
- Chilled water coil, NC modulating valve, antifreeze pump
- Cooling coil discharge temperature sensor
- Heating coil, NO modulating valve
- Humidifier, steam NC modulating valve, NC 2 position valve
- Heating coil discharge temperature sensor
- Smoke detector
(Compare with mixed air system)
- Hood connection points

8.9.4.2.1.2 Occupant zone
- Occupant override
- Humidity sensor
- Temperature sensor

8.9.4.2.1.3 Exhaust air duct
- Smoke detector
- Air flow monitor
- Heat recovery coil
- Exhaust fan

8.9.4.2.2 Typical point list

8.9.4.2.2.1 Analog inputs
- Outside air temperature
- Heat recovery discharge temperature
- Pre-heat discharge temperature
- Cooling coil discharge temperature
- Heating coil discharge temperature
- Zone temperature
- Zone humidity
- Supply fan air flow
- Exhaust fan air flow
- 3 heat recovery loop temperatures

8.9.4.2.2.2 Binary inputs
- Supply fan status
- Exhaust fan status
- Heat recovery pump status
- Occupant override

8.9.4.2.2.3 Analog outputs
- Supply fan speed
- Exhaust fan speed
- Pre-heat modulating valve
- Chilled water valve (Coil or building as required)
- Hot water valve
- Humidifier valve
- Heat recovery loop valve

8.9.4.2.2.4 Binary outputs
- Supply fan start/stop command
- Exhaust fan start/stop command
- Heat recovery pump start/stop command
- Pre-heat 2 position valve
- Humidifier 2 position valve
- Anti-freeze pump
- Outside air damper

8.9.4.2.2.5 Direct connected safeties
- Freeze-stat
- Supply fan smoke detector
- Exhaust fan smoke detector
- Outside air damper
- Pre-heat 2 position valve
- Outside air damper limit switch
- Supply fan
- Exhaust fan
- Hot water valve

8.9.4.2.3 Safety and shutdown features

8.9.4.2.3.1 All safety shut downs shall be hardwired into the system.

8.9.4.2.3.2 In the event of a smoke alarm signal from either smoke detector (exhaust air duct or supply air duct), the supply and exhaust air fans shall shut down and the outside air dampers shall close.

8.9.4.2.3.3 A manual reset freeze-stat on the upstream face of the cooling coil will stop the supply and exhaust air fans, close the outside air dampers and open the modulating preheat valve.

8.9.4.2.3.4 An outside air damper limit switch will stop the supply and exhaust fans when the dampers are not open. Add a spring return on the damper to close the damper in case of power outages.

8.9.4.2.3.5 The 2 position humidifier valve will be closed upon shut down of supply air fan by using an analog DDC.

8.9.4.2.3.6 For VAV systems, a manual reset high limit static pressure sensor shall be located in the discharge ductwork near the fan discharge. It shall shut down the supply air fan whenever the static pressure is greater than the set point.

8.9.4.2.4 Occupied/Unoccupied Cycle

8.9.4.2.4.1 Occupied/unoccupied cycle for the AHU will be determined by the controller scheduling program.

8.9.4.2.4.2 During occupied cycle the fans run continuously. During the unoccupied cycle the fans are off, the outside damper is closed and the preheat coil remains in control. (Close outside air damper on 100% outside air system? - Okay for offices but not labs. - Review system design with Facilities Planning Staff.)

8.9.4.2.4.3 During the unoccupied cycle, a zone temperature sensor will enable the AHU system if the zone setback set point is reached.

8.9.4.2.4.4 All systems will have an occupant override button located in the occupied zone.

8.9.4.2.5 Preheat Control

8.9.4.2.5.1 With the outside air below 55°F, the preheat valve modulates to maintain preheat discharge air temperature set point.

8.9.4.2.5.2 With the outside air below 35°F, the 2 position preheat valve opens. The valve is sized for 10°F rise at full air flow.
8.9.4.2.5.3 With the outside air above 55°F, the preheat valves will be closed.

8.9.4.2.6 Static Pressure Control for VAV Systems

8.9.4.2.6.1 The controller shall maintain the static pressure set point in the supply air ductwork by varying the speed of the fans.

8.9.4.2.6.2 Ramp functions will be accomplished in the variable frequency drive controls, not in the EMS controller software.

8.9.4.2.6.3 Building pressure will be maintained by matching the supply air and exhaust air flows, as measured by flow monitoring stations.

8.9.4.2.7 Chilled Water Coil Control

8.9.4.2.7.1 In the cooling mode (OA>55°F), the controller shall maintain the cooling coil discharge air temperature set point by modulating the two-way cooling coil valve.

8.9.4.2.7.2 In the dehumidification mode (OA>55°F & Zone RH >60%), the controller shall maintain the dehumidification set point by modulating the two-way cooling coil valve.

8.9.4.2.7.3 In the heating mode (OA<55°F), the controller shall shut the cooling coil valve. The temperature setting may be lower for some conditions.

8.9.4.2.7.4 When OA<35°F, the antifreeze pump will be energized.

8.9.4.2.8 Heating Coil Control

8.9.4.2.8.1 In the dehumidification mode (OA>55°F & Zone RH >60%), the controller shall maintain the discharge air temperature set point.

8.9.4.2.8.2 In the heating mode (OA<55°F), the controller shall maintain the heating coil discharge air temperature set point by modulating the heating coil valve.

8.9.4.2.9 Humidifier Control

8.9.4.2.9.1 In the cooling mode (OA>55°F), the controller shall shut the modulating humidifier valve and the 2 position valve. The 2 position valve will be used to stop the flow of steam to the steam jacket and humidifier.

8.9.4.2.9.2 In the heating mode (OA<55°F), the controller shall maintain the humidification set point by modulating the humidifier valve. The 2 position valve will open. (Set to 45° or 50°? Provide deadband.)

8.9.4.2.10 Heat Recovery Control

8.9.4.2.10.1 Energize the heat recovery system when the outdoor air temperature is below 50°F or above 80°F.

8.9.4.3 Mixed Air Systems
8.9.4.3.1 Typical equipment list, in order from outside air intake to exhaust.

8.9.4.3.1.1 Supply air duct
- Outside air sensor
- Outside air damper
- Return Air inlet w/damper in cross connection
- Filter rack
- Air flow monitor
- Supply fan
- Mixed air temperature sensor
- Heating coil, NO modulating valve
- Heating coil discharge temperature sensor
- Freeze-stat, manual reset
- Chilled water coil, NC modulating valve, antifreeze pump
- Cooling coil discharge temperature sensor
- Smoke detector

8.9.4.3.1.2 Occupant zone
- Occupant override
- Temperature sensor

8.9.4.3.1.3 Return air duct
- Return air temperature sensor
- Smoke detector
- Return air fan
- Cross connection to supply air duct
- Exhaust air damper

8.9.4.3.2 Typical Point List

8.9.4.3.2.1 Analog inputs
- Outside air temperature
- Mixed air temperature
- Cooling coil discharge temperature
- Heating coil discharge temperature
- Zone temperature
- Outside air flow
- Return air temperature
- Supply air static

8.9.4.3.2.2 Binary inputs
- Supply fan status
- Return fan status
- Occupant override

8.9.4.3.2.3 Analog outputs
- Supply fan speed
- Return fan speed
- Chilled water valve
- Hot water valve
- Outside air damper
- Return air damper
- Exhaust air damper

8.9.4.3.2.4 Binary outputs
- Supply fan start/stop command
- Return fan start/stop command
- Anti-freeze pump

8.9.4.3.2.5 Direct connected safeties
- Freeze-stat
- Supply fan smoke detector
- Return fan smoke detector
- Outside air damper
- High fan static
- Supply fan
- Return fan
- Hot water valve

8.9.4.3.3 Safety and shutdown features

8.9.4.3.3.1 All safety shutdowns shall be hardwired into the system.

8.9.4.3.3.2 In the event of a smoke alarm signal from either smoke detector (return air duct or supply air duct), the supply, return and exhaust air fans shall shut down and the outside air dampers shall close.

8.9.4.3.3.3 A manual reset freeze-stat on the upstream face of the hot water heating coil will stop the supply, return and exhaust air fans, close the outside air dampers and open the modulating heating valve.

8.9.4.3.3.4 For VAV systems, a manual reset high limit static pressure sensor shall be located in the discharge ductwork near the fan discharge and shut down the supply air fan whenever the static pressure is greater than the set point.

8.9.4.3.4 Occupied/Unoccupied Cycle

8.9.4.3.4.1 Occupied/unoccupied cycle for the AHU unit will be determined by the controller-scheduling program.

8.9.4.3.4.2 During occupied cycle, the fans run continuously. During the unoccupied cycle, the fans are off, the outside air damper is closed and the heating coil remains in control.

8.9.4.3.4.3 During the unoccupied cycle, a zone temperature sensor will enable the AHU system if the zone setback set point is reached.

8.9.4.3.4.4 All systems will have an occupant override button located in the occupied zone.

8.9.4.3.5 Heating coil control

8.9.4.5.1 In the heating mode (OA<55°F), the controller shall maintain the heating coil discharge air temperature set point by modulating the heating coil valve.

8.9.4.3.5.2 In the cooling mode (OA>55°F), the controller shall shut the heating coil valve.

8.9.4.3.5.3 For single zone systems, zone temperature will be used to control the
discharge temperature.

8.9.4.3.4 For systems supplying more than one zone, the discharge air temperature will be reset based on outdoor air temperature.

8.9.4.3.6 Chilled Water Coil Control

8.9.4.3.6.1 In the cooling mode (OA>55°F), the controller shall maintain the cooling coil discharge air temperature set point by modulating the cooling coil valve.

8.9.4.3.6.2 In the heating mode (OA<55°F), the controller shall shut the cooling coil valve.

8.9.4.3.6.3 When OA<35°F, the antifreeze pump will be energized.

8.9.4.3.6.4 For single zone systems, zone temperature will be used to control the discharge temperature.

8.9.4.3.6.5 For systems supplying more than one zone, the discharge air temperature will be reset based on outdoor air temperature.

8.9.4.3.7 Outside Air Control

8.9.4.3.7.1 When OA<65°F, modulate outside air, return and exhaust air dampers to maintain discharge air temperature set point.

8.9.4.3.7.2 When OA>65°F, maintain minimum outside air position.

8.9.4.3.7.3 Air flow monitor will be used to control minimum outdoor air position.

8.9.4.3.7.4 When no chilled water is available and when the outside air is 5°F less than the return air, open the outside air and exhaust air dampers to cool and ventilate the occupied zones.

8.9.4.3.7.5 When a CO2 monitor is used, maintain the return air set point through a point interface device loop by modulating outside air, return air, and exhaust air dampers. Make sure to anticipate if outside air is too cold in the design of the control system.

8.9.4.3.8 Static Pressure Control for VAV Systems

8.9.4.3.8.1 The controller shall maintain the static pressure set point in the supply air ductwork by varying the speed of the fans.

8.9.4.3.8.2 Ramp functions will be accomplished in the variable frequency drive controls, not in the EMS controller software.
CHAPTER 9—ELECTRICAL SYSTEMS

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CHAPTER 9---ELECTRICAL SYSTEMS

Section 9.1 General Requirements

9.1.1 When installing or changing equipment, the designer shall evaluate available fault currents and size the ampere interruption capacity accordingly.

9.1.2 Electrical Systems shall be designed to meet the most recent NEC codes.

9.1.3 Lamp Disposal

9.1.3.1 As of January 6, 2000 the Environmental Protection Agency (EPA) requires that all fluorescent, mercury vapor, and high intensity discharge (HID) lamps be disposed of properly (recycled). Lamps can no longer be disposed of as trash. The Department of Environmental Health & Safety will be responsible for accumulating and recycling all lamps on campus. For large quantities, arrangements can be made for delivery of lamps to the Hazardous Waste Facility on Kimball Ave. Pickups for smaller quantities will be made by EH&S.

9.1.3.2 Packing Tips: Lamps should be placed back into the original boxes, without the padding. Boxes of 4’ fluorescent lights should be able to hold 30-36 bulbs without padding. If you have 6’, 8’, or U-bent bulbs treat them the same as the 4’ bulbs. Please keep the boxes intact so they can be resealed. Do not wrap bare bulbs with tape. Please seal each box end with clear tape. If bulbs are broken please place them into a separate box.

Section 9.2 Distribution Systems

9.2.1 Duct bank systems (concrete encased)

9.2.1.1 It is preferred that all duct banks have a minimum of 3’ of earth cover. Instances that do not allow this amount of cover must be approved in advance and in writing by the owner.

9.2.1.2 Duct shall be type DB PVC. In runs over 100', the designer shall evaluate the need for galvanized rigid steel elbows to prevent damage during cable installation.

9.2.1.3 All duct shall be installed in such a manner to prevent accumulation of water that may be subject to freezing.

9.2.1.4 A warning tape that is a minimum of 6" wide shall be installed 18" above all duct banks.

9.2.1.5 Upon completion of the installation of the duct and prior to pulling any cable in the duct, a mandrel □ smaller than the normal size of duct shall be pulled through the duct.

9.2.1.6 Duct bank penetrations into manholes shall continue completely through the wall of the manhole and shall use one larger hole rather than several small holes. If the above method is not practical, the concrete may stop outside the manhole but must be pinned to the manhole with steel pins to prevent differential settlement.

9.2.1.7 Duct bank penetrations of foundation wall shall comply with Section 2.5.2, Electrical Duct Banks.

9.2.1.8 All unused duct shall have a nylon or polypropylene pull string installed for future use. The pull string shall be Greenlee or equal with a minimum of 240 lbs. tensile strength, and shall be rot and mildew resistant. Wire shall not be used.

9.2.1.9 Concrete

9.2.1.9.1 The concrete shall cover the duct a minimum of 3" in all directions, and a maximum of 6".
9.2.1.9.2 The concrete shall be 4,000 psi and shall have the color additive Colorcron - Tile Red manufactured by Masterbuilders; Solomon Grind Chemical Services #140 Red, or approved equal. The color additive shall have a minimum concentration of 9 lbs. per bag of cement and shall be mixed throughout all of the duct bank concrete.

9.2.1.9.3 The maximum aggregate size shall be 3/4".

9.2.1.9.4 The concrete shall be placed with the aid of a mechanical vibrator.

9.2.1.9.5 If trench erosion occurs, the use of forms may be required to prevent overly large masses of concrete.

9.2.1.10 Minimum reinforcing of the concrete shall be as follows:

9.2.1.10.1 The minimum size is #4.

9.2.1.10.2 The reinforcing shall be installed longitudinally, at each corner of the duct (in cross section) and along the top, bottom, and sides at a maximum of 6" on center. All reinforcing steel shall have a minimum concrete cover of 1/2".

9.2.1.10.3 Reinforcing shall be installed latitudinally, as needed to hold the above in place during placement of the concrete.

9.2.2 Direct burial systems

9.2.2.1 All directly buried cable shall have a minimum of 45" of earth cover with a minimum of 3" of sand placed both above and below the cable.

9.2.2.2 Two warning tapes, that are a minimum of 6" wide, shall be installed 18" and 36" above all directly buried cable.

9.2.2.3 Penetrations into manholes shall be run in Schedule 40 PVC conduit from the interior of the manhole to a point not less than 8' outside the manhole. A bell end shall be installed on each end of the conduit. The conduit shall be graded to drain any moisture away from the manhole.

9.2.2.4 Entrance into transformer pads shall be run in Schedule 40 PVC conduit. The cable shall maintain the minimum 48" of depth, then turn up directly below the transformer pad. The conduit shall extend from the surface at the transformer pad to a point not less than 8' outside of the perimeter of the transformer pad. A bell end shall be installed on each end of the conduit.

9.2.3 Medium voltage (600 volts - 35,000 volts)

9.2.3.1 Equipment

9.2.3.1.1 Transformers

9.2.3.1.1.1 The designer shall evaluate the anticipated building harmonics to determine the K rating for each transformer installation. The K factor shall be determined as follows:

Transformer K-Factor (Harmonic rating): The transformers shall be designed to operate at full kVA rating while carrying harmonic current contents as defined by the indicated K-Factor. Harmonic current content shall be defined as odd harmonics (3rd through 15th order) which are all equal in their percentage of the fundamental (60 Hertz) frequency. K-Factor shall be defined as follows:

\[ K = \frac{\sqrt{hi}}{fhi} \]

where \( hi \) = harmonic frequency, given as an integral multiple of the fundamental frequency, and \( fhi \) = harmonic distortion, for the ith harmonic, as percent of the unit fundamental frequency.

Transformer nameplates shall be clearly marked with the transformer K-Factor rating.
9.2.3.1.2 Fusing of transformers shall coordinate with the owner’s first upstream device.

9.2.3.1.3 In all transformer installations, especially retrofit or replacement, the secondary system fault current shall be analyzed.

9.2.3.1.2 Switch Gear

9.2.3.1.2.1 All pad-mounted switch gear shall be type PMU or System 2, as manufactured by S&C.

9.2.3.1.2.2 All switch gear and switch gear components must be rated for 25 KA (symm) available fault current and be tested to 25 KA (symm) by an independent testing agency.

9.2.3.1.2.3 All switch gear shall be above ground type.

9.2.3.1.3 Circuit breakers shall be GE double high vacuum, rated to 1,000 MVA, and designed to be electrically, mechanically interchangeable with the owner’s existing GE vacuum circuit breakers and work with the owner and SCADA System.

9.2.3.2 Execution

9.2.3.2.1 All cable installations where the calculated pulling tension exceeds 67% of the manufacturer’s recommended maximum tension shall be installed using tension measuring equipment. The owner’s representative must be present to observe these installations. These cable runs shall be clearly marked on the plans.

9.2.3.2.2 All cable pulled through wet or damp conduit shall be sealed on the end to prevent any moisture from entering the insulation.

9.2.3.3 Testing

9.2.3.3.1 Medium Voltage Cable - Direct-current Voltage Test (D.C. HiPot): After installation and prior to being placed in service, all medium voltage cables shall be tested by use of a D.C. HiPot test. Test voltages and procedures shall be in accordance with ICEA standard S-68-516/NEMA standard WC-8 (latest edition). Cable test data shall be recorded on the Medium Voltage Cable Test Data form included in the appendix of this section.

9.2.3.3.2 Transformers: The following test shall be performed on each transformer prior to the unit being placed in service.

9.2.3.3.2.1 Insulation resistance tests (5000 volt MEGGER) shall be performed on high voltage and low voltage windings prior to placing the transformer in service. This test must be approved by the transformer manufacturer prior to testing.

9.2.3.3.2.2 Transformer turns ratio testing shall be done on all transformers prior to energizing. Testing should be done by Contractor on the construction project and Facilities' Shops.

9.2.3.3.2.3 Each transformer shall be energized from the low voltage bushings, and voltages measured (phase to phase) across the high voltage bushings. All primary and secondary voltages shall be recorded and forwarded to the owner.

9.2.3.3.3 All testing shall be witnessed by the Owner’s Representative.

Section 9.3 Secondary Circuits

9.3.1 General Requirements

9.3.1.1 All neutral conductors shall be a minimum of full size. The designer shall evaluate the need for oversized neutral conductors.
9.3.1.2 The preferred method for grounding is through the use of a buried loop or, in new construction, the use of the concrete reinforcing steel. Use of the building steel for grounding shall not be allowed unless the steel was designed for this use or the grounding capability of the steel was tested and found adequate.

9.3.1.3 The designer shall evaluate anticipated building loads for potential harmonic design requirements.

9.3.1.4 No aluminum conductors or busses shall be allowed. All conductors shall be copper. No stabiloy shall be allowed under any circumstances.

9.3.1.5 Load center shall not be allowed. The minimum level of quality is a panelboard or a switchboard.

9.3.1.6 When installing or changing equipment, the designer shall evaluate available fault currents and size the ampere interruption capacity accordingly.

9.3.1.7 Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

<table>
<thead>
<tr>
<th>208/120 Volts</th>
<th>Phase</th>
<th>480/277 Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>A</td>
<td>Brown</td>
</tr>
<tr>
<td>Red</td>
<td>B</td>
<td>Orange</td>
</tr>
<tr>
<td>Blue</td>
<td>C</td>
<td>Yellow</td>
</tr>
<tr>
<td>White</td>
<td>Neutral</td>
<td>White or Gray</td>
</tr>
<tr>
<td>Green</td>
<td>Ground</td>
<td>Green</td>
</tr>
</tbody>
</table>

9.3.2 Service Entrance

9.3.2.1 In new installations, it is preferred that only one disconnect be installed per service entrance. However, if multiple disconnects are installed, no more than 4 disconnects shall be installed, with space allowed for a total of 6 disconnects.

9.3.2.2 At the points where conduit penetrates concrete that is in contact with soil, that conduit shall be Schedule 40 PVC conduit. If the PVC has a bend of greater than 45 degrees, the bend shall be completely encased in concrete. This is to prevent the rusting away of metal conduit at the place it exits the concrete. The concrete encasement is to prevent destroying the PVC bend during the wire installation.

9.3.3 Feeders

9.3.3.1 All feeders shall have a separate grounding conductor installed. In no case shall the conduit or raceway be used as the grounding conductor.

9.3.3.2 All conduit sizes and conductor numbers and sizes shall be shown on the drawings.

9.3.3.3 All panelboards shall have separate grounding and neutral busses. All grounding and neutral wiring shall be terminated on the proper buss.

9.3.3.4 The preferred breaker is the snap-in type.

9.3.3.5 All panelboards shall be sized to allow a minimum of 20% of space for additional breakers, by count of breakers.

9.3.3.6 No piggyback breakers shall be allowed.

9.3.3.7 Breakers on all new or renovation projects will be re-labeled to actual room number before the contractor is out of the building and University takes over.

9.3.4 Branch Circuits

9.3.4.1 All wiring systems shall be installed using conduit. Flexible wiring systems shall not be used. With the exception of using flexible wiring systems to lights and sealite flex
conduit, limited to a 6 ft max run. Over that run length use conduit.

9.3.4.2 The minimum conduit size shall be 3/4", except conduit enclosed in a wall, conduit used for switch legs, and conduit used for control wiring. These exceptions shall have a minimum of 1/2" conduit. The project shall pay for the extra size.

9.3.4.3 A separate grounding conductor shall be installed. Use of the conduit or raceway is not an acceptable grounding method.

9.3.4.4 All general purpose power circuits shall be a minimum of 20 amps.

9.3.4.5 General purpose power circuits in office areas shall not have shared neutrals.

9.3.4.6 Conduit shall be supported from the building structure. Attachment to other pipes, conduits, ductwork, etc. shall not be allowed.

9.3.4.7 Non-metallic conduit or boxes shall not be used except in wet locations. In cases where it is used, conduit 2" and smaller shall be a minimum of Schedule 80.

9.3.4.8 All exposed conduit installed in a finished space shall be painted to match the background.

9.3.4.9 All lighting switching layouts shall be shown on the drawings. The drawings shall show the circuit numbers for each receptacle, and shall show the wire counts for all circuitry.

9.3.4.10 Panelboards shall be supplied with lighting sufficient for working at the panelboard. In some cases this may require the installation of additional lighting.

9.3.4.11 Conductors carrying more than 150v to ground shall not be installed in conduits with conductors carrying less than 150v to ground.

Section 9.4 Devices and Motors

9.4.1 Devices

9.4.1.1 All receptacles and switches shall meet the requirements of ADA. The preferred mounting heights, above finished floor, are 48" for switches and 18" for receptacles.

9.4.1.2 All receptacles and switches shall have a minimum rating of 20 amps and shall be heavy duty specification grade. A standard of quality for switches is Leviton #1221 and for receptacles is Hubbell #5362-1. Preferred cover is metal.

9.4.1.3 The preferred color for receptacles and switches is brown. Receptacles in hallways shall have stainless steel covers. Other colors may be used to match existing devices or for special uses.

9.4.1.4 Each restroom must have at least one receptacle and it must be a GFI receptacle. The project will pay for this.

9.4.1.5 In areas that are required to have ground fault interrupting capability, it is preferred that GFI receptacles be used rather than GFI breakers.

9.4.1.6 The designer shall use brushed stainless steel covers appropriate for the usage of the area.

9.4.2 Fuses

9.4.2.1 Renewable fuses shall not be used.

9.4.2.2 As much as possible, equipment should be specified with fuse holders that will accept fuses that are dimensionally the same as Class H fuses.

9.4.2.3 Each project shall supply one set of three spare fuses for each type and size fuse installed.
9.4.2.4 The designer shall evaluate the need for a box for storage of the spare fuses. If a box is installed, it shall be a metal box designed to store fuses and mounted in a highly visible, but Facilities' controlled, location and labeled appropriately.

9.4.3 Safety Switches

9.4.3.1 All safety switches shall be heavy-duty grade, within reach of devices and controls.

9.4.3.2 All safety switches shall have a durable label permanently attached to the inside cover that describes the fuse size, type, current-limiting ability and devices controlled. (Device-controlled only).

9.4.3.3 All safety switches intended for use on circuits where current-limiting fuses are required shall be specified with rejection clips designed to permit installation of Class R fuses only.

9.4.3.4 The covers on safety switches shall be provided with a method of opening the cover without opening the switch. If the switch doesn't allow for this, change the switch.

9.4.3.5 Safety switches in mechanical rooms shall have NEMA 3R enclosures unless the environment or usage requires a different enclosure.

9.4.3.6 All safety switches shall have a grounding bar.

9.4.4 Motors

9.4.4.1 All motors shall meet ASHRAE 90.1 and EMO Energy Conservation Policy #060 (Appendix 2), and shall have a minimum service factor of 1.15.

9.4.4.2 The designer shall evaluate the possibility of using 480v whenever practical. It should be noted, however, that 90% of buildings at KSU don't have 480v at present.

9.4.4.3 No motors shall be designed to operate in the service factor.

9.4.4.4 The designer shall evaluate the use of soft starting whenever appropriate.

Section 9.5 Communications and Alarm Systems

9.5.1 Telephone and Data Systems

9.5.1.1 General Guidelines

9.5.1.1.1 In general, the contractor will install the wall boxes and any required conduit, with pull strings. In general the project will provide funding for all wiring and termination devices. KSU Telecommunications will install all wiring and termination devices. If the contractor will be installing any wiring on a particular project, the full cable specification shall be obtained from KSU Telecommunications.

9.5.1.1.2 A minimum of one voice and one data cable shall be installed for every 100 sf. of office area.

9.5.1.1.3 The design of all communications systems shall be coordinated with KSU Telecommunications and Facilities Planning.

9.5.1.2 Telecommunications Closets

9.5.1.2.1 All telecommunications closets should be considered as potential locations for ancillary electrical equipment as well as the basic termination of Cable/Wire/Fiber. As such, the following are EIA basic standards for such spaces:

Size: Minimum size requirements – 5’ by 6’ with door opening out or 5’ by 8’ with door opening into the room.
Ceiling Height: 8’ minimum ceiling height.

Doorways: Minimum measurement of 3’ wide by 6’-8” high. These measurements do not include a door sill or center post.

9.5.1.2.2 Location: A minimum of one telecommunications closet shall be located on each floor. Distance limitations or other considerations may require more than one closet on each floor. Closets should be located as close to the core of the structure as possible and should be stacked one above the other in multiple floor buildings. One closet should be allocated for every 10,000 sq. ft. Average cable runs should be 150 horizontal feet with no single cable run exceeding 295 feet.

Dust and Static: Install tile and/or seal concrete.

9.5.1.2.3 Power: Each closet must have a minimum of two 120V AC duplex outlets. Outlets must be separately fused, 20 amp, 3-wire grounding and on a non-switched circuit. The outlets should be located below the termination board location, if known.

Lighting: Minimum equivalent of 538 lux measured at 4’ above finished floor.

9.5.1.2.4 Conduit/Cores: Each closet must be constructed with a minimum of 2-4 inch cores equipped with sleeves extending a minimum of 1 inch above finished floor. Two additional 4” cores are required for each additional 10,000 square feet per floor.

9.5.1.2.5 Environment: Temperature ranges 65°F to 95°F; humidity ranges 20% to 60% relative; heat dissipation 750 to 5,000 BTU’s per hour per cabinet.

9.5.1.2.6 Electrical: Each manufacturer’s equipment is different. The following are requirements generic to all systems requirements:

- 2-4 inch conduits per 200,000 square feet of usable office space.
- One spare conduit for each 2 conduits to be used.
- No more than 2 - 90° bends between pulling points.
- All ends of metallic conduit must be reamed and brushed.
- All conduits shall have a pull string installed.
- Metal sleeves through foundation walls must extend a minimum 20’ beyond the wall.

9.5.1.3 Pathways (interior)

9.5.1.3.1 Pathways must support cables and provide protection. Pathways should be planned to facilitate original installation of voice/data cabling as well as ongoing maintenance, additions, and relocations. For new construction and in renovations where possible, cable trays or conduit for horizontal distribution shall be installed in corridors. In renovations of existing facilities, existing conduits or other pathways may be used.

9.5.1.3.2 Sections of conduit shall be no longer than 100’ and must not have more than 2 bends between pull points or pull boxes with individual bends not to exceed 90°. Inside bending radius must be at least six (6) times the inside conduit diameter for conduit 2” or less and at least 10 times the conduit diameter for conduit greater than 2”. Pull boxes should be placed directly after a bend or sized accordingly if the pull box is located at the bend. Designer is to verify types of cable used with KSU Telecommunications and make sure conduit bending radius conforms to type of cable used.

9.5.1.3.3 The conduit shall be sized to avoid exceeding the following cable fill maximums:

- 3” conduit - 50 cables maximum
- 2” conduit - 22 maximum
- 1” conduit - 7 cables maximum
- 3/4” conduit - 4 cables maximum
Terminal boxes shall be standard electrical boxes; 2" x 4" x 2" mounted flush with the wall surface in new construction. In existing buildings the terminal boxes may be surface-mounted where necessary. Surface-mounted boxes shall be single gang deep switch and receptacle boxes, 4 5/8" x 2 7/8" x 2 1/4"; wiremold 5744S or approved equal.

9.5.2 Fire Alarm Systems

9.5.2.1 All new buildings and major renovations shall include a central, addressable system.

9.5.2.2 All fire alarm systems shall comply with ADA.

9.5.2.3 Drawings for fire alarm systems shall include zoning and locations for each device on the plan view and a riser diagram. The use of addressable systems with LED reader of each device's location is preferred.

9.5.2.4 Acceptable brands for fire alarms systems are Faraday, Honeywell, Notifier, Simplex, FCI, and Powertronics. Simplex is the preferred system to match current University systems.

9.5.2.5 The vendor for fire alarms systems must show the ability to respond to requests for service within 24 hours and the ability to supply replacement parts for the system within 48 hours.

9.5.2.6 All new fire alarm panels must be expandable. The future ability to provide fire alarm service for the entire building is desired.

9.5.2.7 All fire alarm panels shall be equipped with a “walk test” feature. This allows each activating device to be tested without the need to reset the panel after each device is activated.

9.5.2.8 All fire alarm panels shall be equipped with a “building evacuate” switch.

9.5.2.9 All fire alarm panels shall be located at the main entrance of the building or shall have a remote annunciator located at the main entrance. A diagram of the building showing the various zones shall also be located at the main entrance.

9.5.2.10 Pull stations shall be located at all building and floor entrances.

9.5.2.11 If a security system is available in the building where a new fire alarm panel is being installed, the fire alarm panel shall be connected to the security system to allow reporting of a fire alarm to the Campus Police through the security system. All fire alarm panels shall be capable of reporting through the security system or other external system.

9.5.2.12 If an Energy Management Controls System (EMS) is available in the building where a new fire alarm panel is being installed, the fire alarm panel shall be connected to the EMS.

9.5.2.13 If door hold-opens are used, they shall be a wall-mounted, magnetic type with proper mounting blocking in the wall. Combination door closer/hold-opens shall not be used.

9.5.2.14 All pull stations shall be key operated, keyed the same as the building fire alarm panel. All keying shall be coordinated with the KSU Public Safety.

9.5.2.15 Ionization type smoke detectors shall not be installed in mechanical rooms.

9.5.2.16 All smoke detectors or other activating devices shall be installed in locations that are readily accessible for maintenance. Beam detectors shall be used in atriums or other high ceiling areas.

9.5.2.17 When fire alarm systems are installed in buildings with elevators, provisions shall be included for alternate floor controls.

9.5.2.18 All wiring for fire alarm systems shall be either Type FPLM, plenum rated cable or an acceptable cabling in conduit.

9.5.3 Security Systems
9.5.3.1 For all new buildings and major renovations, the designer shall evaluate the need for a security system.

9.5.3.2 All security systems must be compatible with the existing campus wide annunciator system in use by the University Police.

9.5.3.3 Security systems may be a part of the construction contract, not a separate project. Typically, security is sold to departments for a monthly charge.
## DC TEST DATA

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</table>

### Cable Data:
- Installation: New____ Used____
- Size ______ Length ______(feet)
- Rated Voltage ___________________________
- Manufacturer ___________________________
- Insulation wall _________________________
  (type and thickness)
- Conductor jacket wall ___________________
  (type and thickness)
- Shield type ____________________________
- Type terminations _______________________
- Type & location of splices ___________________

### Test Equipment:
- Manufacturer ___________________________
- Model ___________________________

### Test Conditions:
- DC Test Voltage _________________________
- Temperature _____________________ Humidity _____________________
APPLICATION OF TEST VOLTAGE

The initially applied direct-current voltage shall not be greater than 3.0 times the rated alternating-current voltage. The rate of increase from the initially applied voltage to the specified test voltage shall be uniform and shall not be over 100% in 10 seconds nor less than 100% in 60 seconds. The duration of the direct-current voltage test shall be 15 minutes for shielded cables and 5 minutes for nonshielded cables. Test voltage for newly installed 15 KV cable with 220 MIL (133%) insulation shall be 65 KVDC in accordance with ICEA/NEMA standards.
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Section 10.1  Landscaping

10.1.1 The designer is referred to the guide specification for landscaping located in Appendix 1. It is noted that this specification is only a guide and must be edited before inclusion in a project specification.

10.1.2 All site access shall be clearly shown on project drawings.

10.1.3 All construction fencing shall be shown on the project drawings, including fencing for protection of trees.

Section 10.2  Parking Lots

10.2.1 All parking lots shall comply with ADA requirements.

10.2.2 The maximum desired slope is 4%. Slopes greater than 4% must be approved by the owner.

10.2.3 All parking spaces for disabled access shall be “universal spaces.”

10.2.4 Paint colors shall be white for general lot stripping, yellow for no parking areas, and blue for disabled access spaces and areas.

10.2.5 Parking spaces shall typically be 9’ in width. No compact car spaces shall be permitted.

10.2.6 Asphalt surfaced lots shall have a minimum cross section of 3” of asphalt surface, 6” of crushed stone Type 1 aggregate for base, and an underlayment of geotextile fabric.

10.2.7 Concrete surfaced lots shall have a minimum cross section for 6” of concrete and 6” of Type 1 aggregate for base. The concrete shall be Portland cement concrete with a heavy broom finish. All reinforcement shall be epoxy coated. All joints shall be shown on the plans and shall be sealed with traffic grade caulking.

10.2.8 At locations where a parking lot is adjacent to lawn areas, a mowing strip is a strip of pavement, 18”-24” in width, on the lawn side of the curb or parking bumpers that allows the lawn to be mowed while the parking spaces are occupied.

Section 10.3  Sidewalks and Ramps

10.3.1 Sidewalks shall be designed with positive drainage away from walks. Drainage of surface water shall not cross sidewalks.

10.3.2 Sidewalks and ramps shall be designed to prevent water entering a building. Overflow areas shall be provided if necessary.

10.3.3 All sidewalks shall have a minimum width of 5’ and a minimum thickness of 6”. Where a sidewalk is adjacent to a road or driveway, the minimum width is 9’. Walks adjacent to roads or driveways should have a grass strip between the sidewalk and the road or driveway, if space allows.

10.3.4 Lateral slope for sidewalks shall be no less than 1% and no more than 2%.
10.3.5 Curb cuts for disabled access shall use the KSU standard detail. The detectable warning area shall be a contrasting color with a warning texture.

10.3.6 Materials

10.3.6.1 The preferred material for sidewalks, ramps and other paved, exterior walking surfaces is concrete. No material shall be used for a walking surface that may become slippery when wet.

10.3.6.2 Concrete:

Minimum strength 4000 psi
Flint & Chert 1% maximum, by weight, of the coarse aggregate
Lignite 0.07% maximum, by weight, of fine aggregate
Air 6% (+/- 1%)
Reinforcing Epoxy coated steel, minimum 6" x 6" # 1.4 x 1.4 welded wire fabric

10.3.6.2.1 Base for concrete shall be a minimum of 4" of Type 1 aggregate for base.

10.3.6.2.2 Joints

10.3.6.2.2.1 All joints shall be shown on the plans
10.3.6.2.2.2 Joints may be either tooled or sawn. If the joints are sawn, they shall be sawn within 12 hours of the placement of the concrete.
10.3.6.2.2.3 Joints shall be a minimum of 2" deep or 25% of the slab thickness, whichever is greater.
10.3.6.2.2.4 All joints shall be sealed with traffic grade, non-asphalt, non-extruding gray polyurethane sealant.
10.3.6.2.2.5 Construct control, construction and expansion joints true to line with faces perpendicular to surface plane of concrete. Construct traverse joints at right angles to the centerline, unless indicated otherwise. Existing paving – traverse joints to align with previously placed joints.

10.3.6.2.3 A medium broom finish shall be applied perpendicular to the traffic flow. All brooming directions shall be shown on the drawings and described in the specifications.

10.3.6.2.4 Use of calcium chloride shall not be permitted.

10.3.6.2.5 Testing

10.3.6.2.5.1 The concrete shall be tested for strength, air entrainment, temperature, and slump. The specifications shall indicate allowable limits for each.
10.3.6.2.5.2 The University will retain the services of a testing firm. The contractor shall be responsible for scheduling the tests. The contractor shall be required to notify the owner’s representative a minimum of 48 hours prior to all placement of concrete.
10.3.6.2.5.3 Concrete shall be tested at the minimum rate of one test for each additional 50 CY placed. The concrete may be tested more often at the discretion of the owner’s representative.

10.3.6.2.5.4 The specifications shall make clear to the contractor the responsibility to comply with the specifications.

10.3.6.6 Aggregates

10.3.6.6.1 Normal-Weight Aggregates: Concrete aggregates shall conform to the “Standard Specifications for Concrete Aggregates” (ASTM Designation: C33) and to Section 1102 of Standard Specifications for State Road and Bridge Construction Kansas Department of Transportation, 1990 Edition.

10.3.6.6.2 Coarse Aggregate shall be clean crushed stone or coarse gravel of the following quality:

- Soundness, minimum: 0.90
- Wear, maximum: 50%

10.3.6.6.2.1 Gradation for coarse aggregate shall conform to the following gradations:

<table>
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<th>Percent Retained</th>
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<tbody>
<tr>
<td>1 inch</td>
<td>0</td>
</tr>
<tr>
<td>¾ inch</td>
<td>0-5</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>40–60</td>
</tr>
<tr>
<td>No. 8 (0.097 inch)</td>
<td>95-100</td>
</tr>
</tbody>
</table>

10.3.6.6.3 Fine Aggregate shall consist of natural sand resulting from disintegration of siliceous and/or calcareous rock and shall conform to the following gradations:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4 (0.185 inch)</td>
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</tr>
<tr>
<td>No. 8 (0.097 inch)</td>
<td>0-24</td>
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<tr>
<td>No. 16 (0.049 inch)</td>
<td>15-50</td>
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<tr>
<td>No. 30 (0.0232 inch)</td>
<td>40-70</td>
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<tr>
<td>No. 50 (0.0117 inch)</td>
<td>70-90</td>
</tr>
<tr>
<td>No. 100 (0.0059 inch)</td>
<td>90-98</td>
</tr>
</tbody>
</table>

10.3.6.3 Paving brick

10.3.6.3.1 Brick used as paving shall not be set in a sand base if there will be any vehicle traffic on the paving. If the brick paving will be used in areas for vehicular traffic a concrete base shall be designed to carry the traffic loads required.

10.3.7 Guardrails and Handrails

10.3.7.1 This standard shall apply to all exterior guardrails and handrails that are not a significant part of a building’s architecture.

10.3.7.2 All railings shall comply with the latest version of the ADAAG.

10.3.7.3 Materials
10.3.7.3.1 All guardrails and handrails shall be primarily constructed of steel pipe (or square tubing). The infill for guardrails shall be constructed of vertical balusters only. No panels shall be used for the infill.

10.3.7.3.2 Prior to installation, the bottom 18" of the railing uprights imbedded in concrete shall be dip galvanized. Any repairs or alterations shall receive a galvanizing coating prior to being painted.

10.3.7.4 All railings shall be of welded construction.

10.3.7.5 All railings shall be painted gray with a high gloss enamel paint to match the campus standard.

10.3.7.6 Installation

10.3.7.6.1 The preferred method of installation is to imbed a galvanized pipe sleeve in the concrete of the ramp, sidewalk, etc., that has an inside diameter 1" greater than the outside diameter of the railing post. This space is filled with a non-shrinking grout to secure the post in place. The grout shall fill the space completely and shall be mounded or raised adjacent to the post to drain water away from the post. No welding shall be allowed at this connection.

10.3.7.6.2 If necessary the posts may be secured to the sidewall of the ramp, steps, etc. If this attachment is used, the design shall prevent trapping water.

Section 10.4 Storm Drainage

10.4.1 The return period to be used for the design of areas such as pedestrian malls, streets, and quadrangles shall be 25 years with a 15-minute duration.

10.4.2 The return period for areas such as parking lots, park space, and similar areas shall be 10 years with a duration of 15 minutes. Time of concentration to the utmost inlet shall be 15 minutes. If the “open” areas under consideration is indicated as a future development areas on campus master plan documents, then longer return period shall be used as directed by the owner.

10.4.3 For areas not clearly defined as stated above, the owner shall recommend the design storm. No ponding above the surface of the inlet shall be allowed based on the design storm, except in no-paved areas and only as approved by the owner.

10.4.4 The designer shall compare the above return periods with those required by the City of Manhattan. Any discrepancies shall be discussed with KSU Facilities Planning.

10.4.5 Surface detention areas should be incorporated into site designs. No detention areas will be located on paved areas unless they have received prior approval by KSU Facilities Planning.

10.4.6 The consultant, with the approval of the owner, will select an appropriate back water elevation to be used during the design of the project.

10.4.7 For buildings and other structures as directed by the owner, the site plan shall be developed such that no entry of water shall occur during a 100-year storm.

10.4.8 Site plans shall be designed by, or in collaboration with, a Civil Engineer registered in Kansas.

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10.4.9 Particular attention shall be paid to bicycle and wheelchair safety in the design of storm drainage systems. Grate bars shall be placed perpendicular to the direction of traffic flow.

10.4.10 Pipe systems for storm drainage is discussed in Section 7, Mechanical Systems.

Section 10.5 Site Furnishings

10.5.1 Standards

10.5.1.1 Waste Receptacles – Victor Stanley #SC-4 LFI CC 5001 – 24 – 41 Redwood with metal sand pan (25 ½” x 25 ½”) – 1-800-521-2546. Receptacle should be placed 1 foot away from walk to prevent damage from snow removal equipment. Pad should be adequately sloped so as to allow for proper drainage. Pad should be concrete 3500 psi in 28 days, broom finished surface parallel to existing walk. Opening of receptacle should face direction as specified by designer.

10.5.1.2 Bench – Landscape Forms Inc. #106 S Bench 6’ or 8’ Bench LFI Forum FR 3005-BS-72 Redwood, PS Support. Post stand of bench should be welded to 8” square metal plate with 4 mounting holes, and mounted to concrete pavement with anchor bolts. Bench is to be level as possible.

10.5.1.3 Campus Light – Sterner #GS 24 RIAN 250H 208N; 24” Acrylic globe or equal / Sterner # RTS02HADN; 12’ Pole.
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Appendix 1  Landscape Planting

1.1 General

Provisions of the General Requirements, Division 1, are a part of this Division and Section.

1.2 Scope of Work

1.2.1 The work to be done on this contract shall consist of furnishing all materials, labor, and equipment to execute all work for landscape planting and landscape irrigation installation in accordance with these specifications and plans. Work is to include: protection of existing trees and shrubs; finish grading, changes to existing irrigation system; installation of new irrigation, turf grass planting (seeding and/or sodding), planting of all trees, shrubs, perennials, bulbs, and groundcovers; pruning and/or removal of existing trees, shrubs, weeds, and/or stumps; maintenance of turf until acceptance date; and maintenance of all new tree, shrub, ground cover, bulb, and perennial (including ornamental grass) planting beds for one year after Partial Occupancy. (This varies from project to project.)

1.3 Materials

1.3.1 Topsoil

1.3.1.1 Topsoil – a natural or cultivated surface - shall be a soil layer containing organic matter and sand, silt, and clay particles. It shall be friable, pervious, and a darker shade of brown than underlying subsoil. It shall also be reasonably free of subsoil, clay lumps, grass, weeds, brush, roots, stumps, toxic substances, litter, gravel, stones or other materials greater than 1-½" in diameter, and other deleterious material. Topsoil shall not contain plant parts of Nutsedge, Johnson Grass, Nimblewill, Bermuda Grass, Bindweed or other noxious weeds. Topsoil shall not be delivered in a muddy or frozen condition.

1.3.1.2 Soil pH should be 5.5 min., 7.0 max

1.3.2 Soil Amendments

1.3.2.1 Peat Moss – Shall be pulverized type of sphagnum peat with a pH of 3-4, and shall be 1-5% ash, 0.6 – 1.4% N.

1.3.2.2 Iron Sulfate – High Yield, 11% sulfur, 19% iron, trade name: “Copperas” produced by Fertilome – Voluntary Purchasing Group, Bonhomme, Texas, 75418, (903) 583-9789.

1.3.2.3 Elemental Sulfur – 90% sulfur, disintegrating pellets, produced by Fertilome – Voluntary Purchasing Groups, Bonhomme, Texas, 75418, (903) 583-9789.

1.3.3 Mulch
1.3.3.1 Mulch for tree beds and tree/shrub beds shall be hardwood mulch an average of approximately 1 ½” in length, mixed in size. Mulch for ground cover beds shall be premium hardwood mulch, double ground, approximately 1” long, mixed in size. Mulch shall be fresh, clean, and free from soil, rocks, diseased material and foreign organic and non-organic matter. Hardwood chip mulch can be purchased from Foster Brothers, Rt. 1 Box 249, 6465 State Rd. E, Auxvasse, Missouri 65231, (573) 386-2271. Samples are to be brought to the Owner for approval prior to installation.

1.3.3.2 The excelsior blanket shall consist of a machine-produced mat of curled wood excelsior of 80% six-inch or longer fiber length, with consistent thickness and the fiber evenly distributed over the entire area of the blanket. The top side of each blanket shall be covered with photodegradable extruded plastic mesh.

1.3.3.3 For turf, blown mulch shall consist of fresh, clean, and 95% weed-free prairie hay or wheat straw.

1.3.3.4 Heavy jute mesh shall be Soil Saver Type #48 with one inch openings weighing approximately one pound per square yard as available from Jim Walls Co., 12820 Hillcrest Rd., Suite 109, Dallas, Texas 75230, (972) 239-8577, Fax (972) 387-9087 or approved equal. Staples used to secure mesh shall be #11 gauge wire six inches long with a one-inch space between teeth.

1.3.4 Fertilizer

1.3.4.1 The grass starter fertilizer shall be a 10-18-22 Par Ex slow release type with a minimum of 2.7% water insoluble nitrogen (WIN) from IBDU and a minimum .6% iron. The second grass fertilizer applied shall be a 28-3-8 Par Ex slow release type with a minimum of 8.1% WIN from IBDU, 2.5% iron, .5% magnesium, .2% manganese, and .2% zinc.

1.3.4.2 The tree, shrub, and ground cover fertilizer shall be a 14-12-14 Woodace Nursery slow release type with a minimum of 3.2% WIN from IBDU and 8.35% coated nitrogen (sulfur-coated).

1.3.4.3 The grass and tree/shrub fertilizer is available from The Greenkeeper Co., P.O. Box 371123, Omaha, Nebraska 68137, (800) 451-8873.

1.3.4.4 Additional fertilizer for pH modified soil shall be Green Garde slow release micronized iron available from Swecker-Knipp (785) 234-5652.

1.3.4.5 The Contractor shall submit sample labels for approval to the Owner prior to application.

1.3.4.6 The Contractor shall notify the Owner of application time at least 24 hours in advance.
1.3.5 Plant Materials

1.3.5.1 General – All plant material shall conform to the species and cultivars specified in the plant list. No substitutions will be allowed, except where the Contractor has made written application stating the change they desire to make, any alteration in price from this change, if the completion of the project would be materially delayed by unavailability of specified material, and has obtained the written approval of the Owner. All plants in a particular planting bed or planting group shall be of the same size and form. All plants shall conform to the American Standard for Nursery Stock, ANSI Z60.1, as published by the American Association of Nurserymen.

1.3.5.2 Where plants are specified according to height or spread, the height or spread shall take precedence over the container size. No container shall be smaller than specified.

1.3.5.3 If plants of greater caliper or size are selected by the Contractor for any plants herein specified, the diameter of the ball increases proportionately.

1.3.5.4 Plants shall be sound, healthy, vigorous, free from plant diseases, insect pests or their eggs and shall have balanced, healthy, normal root systems. Plants shall be nursery grown stock in a climate compatible with Manhattan, Kansas. Collected stock shall not be accepted.

1.3.5.5 Plants shall not be pruned prior to delivery except as authorized by the Owner. Prune only branches that are damaged, rubbing on other branches, or as directed by the Owner, retaining the natural shape of the plant. In no case shall the central leader of a deciduous or coniferous tree be cut unless specifically directed by the Owner.

1.3.5.6 All plants shall have been transplanted or root pruned at least once in the past three years. All trees shall be at least twice transplanted or root pruned and be from properly spaced blocks in the nursery. Inspection for the required root system will be made upon delivery of the plants to the site. The Contractor shall notify the Owner at least 24 hours in advance of the plant delivery time. No plant material shall be installed prior to inspection by the Owner.

1.3.5.7 Balled and burlapped plants shall be dug with firm natural balls of earth of a diameter not less than specified in the American Standard for Nursery Stock for the respective size and kind of plant material. Plants with balls cracked and broken before or during planting will not be accepted.

1.3.5.8 Balls shall be securely wrapped with burlap and tightly bound with rope or wire.
1.3.5.9 Container grown plants shall have been grown in pots or cans for a minimum of 6 months and a maximum of 2 years and shall have sufficient roots to hold the plant earth ball together when removed from the container.

1.3.5.10 Plant material shall be symmetrical, typical for the variety and species, and shall conform to the measurements specified in the plant list.

1.3.5.11 Plants used where symmetry is required shall be matched as nearly as possible. These situations include hedges, plant massing, and specimen plantings where plants indicated on the plans are of the same species and size.

1.3.5.12 Plants marked "B&B" in the Plants Schedule shall be adequately balled and burlapped with balls not less than the diameter specified in the American Standard for Nursery Stock and of sufficient depth to incorporate enough fibrous and feeding roots necessary for the full recovery of the plant. Container grown material of the same variety and size with an equivalent earth and root ball may be substituted for deciduous trees with a trunk diameter under one inch and for all shrubs and ground covers listed in the plant schedule as balled and burlapped ("B&B"), but not for coniferous and other evergreen trees. Balled and burlapped material of the same variety, size, and equivalent earth ball size may be substituted for all plants listed in the plant schedule in the construction plans as container grown. The ball size of all balled and burlapped material substitutions and container size of all container material substitutions shall conform to the American Standard for Nursery Stock.

1.3.5.13 All balled and burlapped plants that cannot be planted immediately upon delivery shall be set on the ground in the shade and the balls well covered with soil, mulch or other acceptable materials, then watered thoroughly and regularly to maintain good health and vigor, while maintaining a firm earth ball. Container grown plants shall be placed in the shade until time of planting and watered thoroughly and regularly to maintain good health and vigor. Windy storage places shall be avoided or adequate wind breaks and protection shall be provided by the Contractor.

1.3.5.14 Bare root deciduous shrubs and perennials, if specified, shall have a well-branched root system characteristic of the species. Root spread to height of plant ratio shall be as outlined in the American Standard for Nursery Stock.

1.3.5.15 Bare root ground cover, if specified, shall have as a minimum one, six inch long healthy runner and a minimum of three, four inch long healthy roots.

1.3.5.16 Potted ground cover shall have at least the minimum number and length of runners, for the specified pot size, as outlined in the current edition of the American Standard for Nursery Stock.

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1.3.5.17 No plants with grafted root stock shall be accepted.

1.3.6 Turf Materials

1.3.6.1 Bluegrass mixture shall contain fresh, clean, new-crop seed with a minimum purity of 98% and minimum germination of 85%. The seed mixture (by weight) shall be 100% improved Kentucky Bluegrass containing at least two varieties, in equal amounts, of acceptable varieties such as Adelphi, America, Baron, Majestic, Ram, Touchdown, or approved equal. *(Note to consultant: this mixture is for overseeding existing Bluegrass areas only.)*

1.3.6.2 Turf- Type Tall Fescue mixture shall contain fresh, clean, new-crop seed with a minimum purity of 98% and minimum germination of 85%. The seed mixture (by weight) shall be improved dwarf turf-type Tall Fescue containing at least two varieties, in equal amounts, of equal color and texture, containing acceptable varieties, including Barlexus, Revolution, Arid, Bonanza, Mustang, Olympic, Falcon, Jaquar, Rebel II, or approved equal. *(Note to consultant: this mixture is the standard campus mixture for new turf installations.)*

1.3.6.3 Tall Fescue mixture shall contain fresh, clean, new-crop seed with a minimum purity of 95% and minimum germination of 80%. The seed mixture (by weight) shall be 90% K31 Tall Fescue and 10% common Kentucky Bluegrass. *(Note to consultant: this mixture is for campus areas that receive extremely low maintenance.)*

1.3.6.4 Sod – General

1.3.6.4.1 Sod shall be an approved, nursery grown turf type dwarf Tall Fescue sod of high quality from certified seed. Sod shall be free of noxious weeds as well as excessive amounts of other crop and weedy plants at the time of harvest. It shall also be free of objectionable grassy and broadleaf weeds. Sod shall be considered free of such weeds if less than 5 such plants are found per 100 square feet of area. Sod will not be acceptable if it contains any of the following weeds: common bermudagrass (wire grass), quackgrass, johnsongrass, poison ivy, nutsedge, nimblewill, Canadian or Russian thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel and bromegrass.

1.3.6.4.2 Sod shall be reasonably free of disease, nematodes, and soil borne insects.

1.3.6.4.3 Sod shall be free of thatch: up to ¼ inch is allowable (uncompressed).
1.3.6.4.4 The Contractor shall submit to the Owner for approval prior to delivery of sod, information as to the field location, species, and percentage of purity of the grass sod intended for use.

1.3.6.4.5 All sod shall be stripped at a uniform solid thickness of approximately 1" plus or minus ¼". Measurement for thickness shall exclude top growth and thatch, and shall be determined at the time of field cutting. Sod thatch, uncompressed, shall not exceed ¼".

1.3.6.4.6 Root development shall be such that standard size pieces will support their own weight and retain their shape when suspended vertically from a firm grasp in the uppermost 10% of area, or when rolled and unrolled 3 times.

1.3.6.4.7 Before stripping, the sod shall be mowed uniformly at a height of 2 to 2 ½ ".

1.3.6.4.8 Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect survival of the sod.

1.3.6.4.9 Sod shall be harvested, delivered, and installed within a period of 36 hours. Sod not transplanted within this period shall be inspected and subject to rejection.

1.3.6.5 Bluegrass sod shall contain a mixture of 100% weight improved Kentucky Bluegrass (two certified varieties at 50% by weight each.)

1.3.6.6 Fescue sod shall be turf-type dwarf Tall Fescue sod or an approved mixture of improved turf-type Tall Fescue and improved Kentucky Bluegrass. Bluegrass content of the mixture shall not exceed 10% by weight.

1.3.7 Herbicide

1.3.7.1 The Fescue post-emergent broadleaf and grassy weed herbicide shall be Trimec Plus as manufactured by PBI/Gordon Corp. applied as required to control weeds in the grass. The pre-emergent herbicide for tree, shrub, bulb and ground cover buds is XL-2G containing Surflan and Benefin as manufactured by Helena Chemical (901) 761-0050. Contractor is to use suitable alternative herbicide for plants not labeled for XL-2G use.

1.3.7.2 All herbicides shall be applied as directed by the product labels.

1.3.7.3 The Contractor shall submit sample labels for approval to the Owner prior to application.

1.3.7.4 The Contractor shall notify the Owner of application time at least 24 hours in advance.
1.3.8 Miscellaneous Landscape Materials

1.3.8.1 Timber Landscape Edging for sign beds shall be 6" by 6" rough-cut Southern Pine, pressure treated with water-borne preservatives for ground contact use. This preservative should be CCA .40 (Chromated Copper Arsenate), complying with AWPB LP-22. Edging shall be secured with ½", reinforcing rod stakes and wood connector strips to match edging, and constructed to sizes as shown in the Drawings. All anchoring nails shall be galvanized.

1.3.8.2 Non-Selective Herbicide shall be Glyphosate as marked under the trade name “Round-Up,” or approved equal. The Fescue post-emergent broadleaf and grassy weed herbicide shall be Trimec Plus as manufactured by PBI/Gordon Corp., applied as required to control weeds in the grass. The pre-emergent herbicide for tree, shrub, bulb and ground cover beds, is XL – 2G containing Surflan and Benefin as manufactured by Helena Chemical (901) 761-0050. Contractor is to use suitable alternative herbicide for plants not labeled for XL – 2G use.

1.3.8.3 Antidesiccant shall be an emulsion-type, film-forming agent designed to permit transpiration and retard excessive loss of moisture from the plants, such as “Wilt-Pruf,” or approved equal.

1.3.8.4 Weed Barrier Fabric, if required by project, shall be a water-permeable, black, polypropylene fabric, 4.0 to 5.0 ounces per square yard product. Fabric shall be Pro 5 Weed Barrier as manufactured by DeWitt Company, RR3, Box 338, Sikeston, Missouri 63801, (800) 888-9669, or approved equal.

1.3.8.5 Tree Wrap is required for newly installed mountain ash, apple, maple, and dogwood.

1.3.8.6 Tree Wrap for maples, dogwoods, and mountain ash shall be double-layered kraft paper with a tar layer between, four-inch wide tape specifically manufactured for tree wrapping.

1.3.9 Guying and Staking Material

1.3.9.1 Tree anchors shall be made of high impact and shock resistant tensaloy aluminum alloy. The anchor holding power for trees of three inch or less caliper shall be 300 pounds and its weight shall be one ounce. Holding power shall be 1100 pounds and anchor weight to be 4.5 ounces for trees of greater caliper than three inches.

1.3.9.2 Cable shall be 7x7 galvanized steel cable with white vinyl coating, which has a breaking strength of no less than 480 pounds for trees of three inch caliper or less and 1700 pounds for trees of greater than three inch caliper.

1.3.9.3 Tree collars shall be 12" long, made from .5 ID x .062 wall PVC tubing with ultraviolet inhibitors.
1.3.9.4 Cable clamps shall be 1/16", zinc plated, U-bolt and clevis type.

1.3.9.5 Anchor shall be driven in with the anchor drive rod specified by the manufacturer.

1.3.9.6 Tree anchor kit for trees of three inch caliper or less shall be Duckbill Model 40 DTS-W, and tree anchor kit for trees greater than three inch caliper shall be Duckbill Model 68 DTS-W, or approved equal.

1.3.9.7 All evergreen trees shall be staked with wood stakes. The stake shall be 2 x 2 sound hardwood and connected to the tree with two strands of twisted 12 gauge galvanized wire within a 2-ply reinforced rubber hose collar (approx. ½ " I.D.).

1.3.10 The Contractor shall install durable, expandable, long lasting polyethylene tree guards at the base of all proposed deciduous trees located in lawn areas. The guards shall be 7 to 10 inches in height and gray in color. The guards shall be the “Tree Protector” as sold by Seaberry Landscape, Inc., 3259 Terminal Drive, Eagan, Minnesota, 55121, (612) 454-9511, or approved equal.

1.4 Quality of Plant Materials

1.4.1 Nursery Growing Conditions – All plant material shall be grown in conditions as closely approximating the project site climatic conditions as possible. Balled and burlapped (B & B) nursery stock shall be dug from field areas that are free from noxious weeds including Bindweed, Nutsedge, Johnson Grass, Bermuda Grass and Canadian Thistle.

1.4.2 Nursery Stock Freshness – All B & B plants shall be freshly dug nursery stock. Heeled-in stock or stock from cold storage shall not be accepted.

1.4.3 All balled and burlapped plants that cannot be planted immediately upon delivery shall be set on the ground in the shade and the balls well covered with soil, mulch or other acceptable material, then watered thoroughly and regularly to maintain good health and vigor, while maintaining a firm earth ball. Container grown plants shall be placed in the shade until time of planting and watered thoroughly and regularly to maintain good health and vigor. Windy storage places shall be avoided or adequate wind breaks and protection shall be provided by the Contractor.

1.4.4 Pruning Prior to Delivery – Plant material shall not be pruned prior to delivery except as authorized by the Owners Representative.

1.4.5 Condition of Nursery Stock – All plants shall have a normal habit of growth for the species and shall be sound, healthy and vigorous; grown at a recognized nursery in accordance with accepted horticultural practice; and free of disease, insects, eggs, larvae and defects, including knots, sun-scales, injuries, abrasions or disfigurement. All cuts over 1-¼" shall be callused over.

1.4.6 Specimen Quality Plants – Bid prices shall permit using specimen stock, which is “better than average nursery row material,” particularly for large deciduous material and evergreen trees. “Specimen quality plants” refers to the quality of
the plant material, as it relates to approval of the plants along with size and branching habit.

1.4.7 Nursery Stock Measurement – Plants shall conform to the measurements indicated on the plant list. The caliber of tree trunks shall be the diameter of the trunk measured 12 inches above the natural surface of the ground.

1.4.8 Nursery Stock Inspection – The Owner reserves the right to inspect the plants at the source and/or on the site before planting for compliance with the requirements. All protective tree trunk covering shall be removed prior to inspection of plants on the site. The Contractor shall furnish the Landscape Architect with a list indicating the source (location – i.e. state, local) of each of the plant types to be supplied. This source list must be submitted within two weeks after receipt of the notice to proceed.

1.4.9 Nursery Stock Delivery – All shipments of plant stock shall comply with existing State and Federal laws and regulations governing plant disease, infection, and interstate movement of nursery stock. Protective covering during delivery shall include covering top and sides of truck to protect from wind burn. Nursery stock with loose or damaged root balls will not be accepted.

1.4.10 Nursery Stock Storage – If planting is delayed for more than six hours after delivery, set plant material in a shaded area, protected from weather and mechanical damage, and keep roots moist by covering with mulch, burlap, or other acceptable means of retaining moisture. Contractor is responsible for watering the heeled-in nursery stock.

1.5 Execution

1.5.1 Preparation

1.5.1.1 Layout – The location for all trees and outlines for all planting beds shall be staked in the ground by the Contractor and must be approved by the Landscape Architect before excavation of planting holes begins. Adjustments in planting locations shall be made by the contractor as directed by the Landscape Architect. The spacing between the center of the shrubs and the edge of the bed shall be equal to the spacing between shrubs unless otherwise noted on the drawings. *Plants shall not cover electric eyes when fully grown and should be planted 2 feet away.*

1.5.1.2 All existing turf and weed areas scheduled for planting bed development shall be sprayed with a non-selective herbicide such as Glyphosate, following manufacturer’s recommended rate of application. Commencement of planting bed construction shall depend on herbicide manufacturer’s recommended waiting period.

1.5.1.3 For all proposed turf areas and planting beds outside of the dripline of existing trees, subgrades soil (6" below finish grade) that has been compacted by vehicles, equipment, material storage, and in other areas designated on the drawings, shall be plowed to a depth of 12” in two directions at 90 degrees to each other by a chisel tooth plow or other suitable machine to loosen the subsurface of the soil. After
plowing, the area shall be regarded to a smooth and even grade. The top 6” of subsoil shall be free of scrap lumber, trash, rocks larger than 3-inch diameter, concentrations of crushed rock, scraps of waste concrete and asphalt, and other deleterious materials prior to topsoil placement.

1.5.2 Planting Trees, Shrubs, Perennials, Bulbs, and Ground Covers

1.5.2.1 Preparation of planting areas:

1.5.2.1.1 Grasses, weeds and other debris shall be removed from all planting beds, shrub, and tree pits to prevent re-establishment of the grasses or weeds. Undesirable grasses and weeds shall be killed by using Roundup at the manufacturer’s recommended rates of application. Additional applications of Roundup will be required if prior applications do not kill the undesirable grasses and weeds. Remove dead plant debris prior to plant bed tilling and plant installation. All removed material shall be legally disposed of off-site away from all University property.

1.5.2.1.2 Prior to planting, till planting beds to an 8” depth. Till planting beds that require soil amendments to a 12” depth. Suitable excess soil shall be used as fill material on the site or removed from the site as directed by the Owner. Prior to planting and mulching, the edges of all planting beds shall be neatly and smoothly outlined with a spaded edge where indicated on the plans. The spaded edge shall be three inches deep in ground cover beds and four inches deep in shrub beds with soil tapered back into the planting bed. The soil surface of the bed shall be raked smooth prior to mulching. The outline edge of all beds shall be established so as to eliminate areas difficult to mow with a riding mower as directed by the Owner. Where tree, shrub, perennial, or ground cover beds abut walks, mow strips, or other pavement, the Contractor shall remove soil along the walk or paved area to a depth of three inches in ground cover beds and four inches in shrub beds and gradually taper the soil back into the planting bed so as to hold the mulch in place. Mulch is to be placed so as to be even with the pavement surface.

1.5.2.1.3 In tree, shrub, perennial, and ground cover beds apply 14-12-14 slow release fertilizer at a rate of one pound actual N per 1,000 square feet. Follow manufacturer’s instructions for method of application. In addition to the 14-12-14 slow release fertilizer, in pH modified beds, apply slow release micronized iron at a rate of one pound per 1,000 (one thousand) square feet.

1.5.2.1.4 Unless otherwise specified by the Owner, all plants shall be set at such a level that after settlement, the crown of the plant will be at or slightly above the surrounding finished grade.

1.5.2.1.5 All pits shall be circular and be excavated to have sloped sides.
and shall be of the minimum dimensions shown in the details of the plans. Each plant to be installed in an individual pit shall be planted in the center thereof. All wire mesh from balled shrubs is to be removed. Wire mesh from balled trees is to be cut vertically to the bottom of ball at four evenly spaced places around ball. The mesh is to be cut off from top one-half of ball and removed. All burlap and lashings from balled and burlapped plants shall be removed from the top one-third of shrub and tree balls after the plant has been placed in the plant pit and immediately prior to backfilling, but no rope lashing or burlap shall be pulled out from under the balls. Remove shrub balls from container grown plants by cutting the cans on two sides with an acceptable can cutter or by carefully removing shrub balls from knock-out containers. After removal from container, the roots on the outside of the shrub ball are to be cut vertically around the ball at approximately 4 inch-6 inch intervals and the root ends “fluffed” so as to encourage them to grow into the surrounding soil and not to girdle the plant. Peat pots may be used for deciduous shrubs and ground cover. Peat pot is to be removed unless the rootball of shrubs would be damaged; then, remove at least top one-third of peat pot and cut vertically around pot at approximately 4 to 6 inch intervals, as approved by the Owner on site. Great care shall be exercised so as not to loosen or break the root ball. Plants with broken balls will not be accepted.

1.5.2.1.6 No material in a frozen condition shall be used for backfilling plant pits.

1.5.2.2 Plants shall be so handled that the roots are protected at all times, and if delivery is made in open vehicles the entire load shall be covered with canvas to prevent desiccation of material. Wind damaged plant material will not be accepted.

1.5.2.3 Plants shall be properly marked for identification with legible, weatherproof labels securely attached thereto before delivery to the site. Labels are to be left on the plants for identification until the Contractor is designated by the Owner to remove them. The labels will be removed at the Partial Occupancy site visit or immediately thereafter as directed by the Owner. All labels shall be sufficiently loose so as not to cause girdling of the plants.

1.5.2.4 No plant shall be so bound with rope, wire, or coverings at any time so as to cause damage to the bark, break branches, destroy its natural shape or impair its vigor.

1.5.2.5 Damaged and unhealthy limbs of trees and shrubs shall be pruned on site. Central leaders of trees shall not be removed without prior consent of Owner.

1.5.2.6 When each plant is placed in the plant pit at the proper level, the backfill will be placed around the plant and settled by watering thoroughly. The backfill shall not be tamped or
packed down by pressure. Further watering of plants is to begin two days after planting, as needed.

1.5.2.7 In the spring, apply a pre-emergent herbicide at the manufacturer’s recommended rate to all tree beds and shrub, perennial, bulb, and ground cover beds after planting and mulching. The Contractor shall use a pre-emergent currently labeled for use with the plant material within the beds. The Contractor shall submit a sample label for approval by the Owner prior to application.

1.5.2.8 Mulch for the trees and shrub planting shall consist of a 3” minimum and a 4” maximum layer of hardwood mulch. Mulch around ground cover plants shall consist of a 2” minimum and 3” maximum layer of hardwood mulch. The mulch layer thickness specified is expected after settlement.

1.5.2.9 All trees shall be braced by sound stakes or guy wires as detailed in the construction drawings, using specific materials. Trees are to be able to sway 3 to 4 inches after staking. Contractor is to remove all stakes, guy wires, and other guying material at the end of the guarantee period.

1.5.2.10 The maintenance shall begin immediately after planting. The trees, shrubs, ornamental grasses, perennial, bulb, and ground cover plantings shall be protected and maintained by watering, pruning, fertilizing, and replanting as necessary up until acceptance of the Project by the Owner at the time of Partial Occupancy so as to assure healthy plants in a vigorous growing condition. After acceptance of the Work, the Contractor shall be responsible for maintaining the newly installed plant materials and plant beds for a period of one year after date of Partial Occupancy. This work shall include watering, weeding, insect and disease control and general care of all woody plants, ground cover, ornamental grass, bulbs and perennials installed in a planting bed under this Contract.

1.5.2.11 Ground cover and shrubs in areas of greater than 10% slope are to be stabilized, if needed, after mulching and before planting with heavy jute mesh. Secure mesh to slope with 6” long wire staples. Down-channel end of roll to overlap upchannel end of roll by 18” and staple 12” on center. Overlap sides of rolls 4” and staple 3’ on center.

1.5.2.12 Soil pH shall be modified with twenty pounds of elemental sulfur per 1000 (one thousand) square feet, five pounds of iron sulfate per 1000 (one thousand) square feet, and three inches of peat on soil surface, all being tilled twelve inches minimum into the soil for plant materials that require soil pH to be less than 7 pH.

1.5.3 Planting of New Turf Areas – Seeding

1.5.3.1 All lawn areas disturbed by construction except tree pits and other tree, shrub and ground cover planting beds, as well as
areas designated on the Drawings to be sodded, shall be seeded as specified below.

1.5.3.2 The seeding operation shall not commence until site conditions are satisfactory. Seeding shall not be done during high winds or when the ground is excessively wet, frozen, or untillable.

1.5.3.3 All areas to be seeded shall meet the specified finish grades and be free of deleterious materials, including weeds, existing grass, tree branches, oil drippings, stones greater than 1-½” diameter, concentration of crushed rock, mortar, and other loose building materials. Finish grade shall consist of a minimum 6-inch topsoil finish layer except where greater thicknesses are noted on the Drawings.

1.5.3.4 Contractor shall protect seeded areas by watering, mowing, fertilizing, applying herbicide and replanting as necessary for as long as is required to establish a uniform stand of grass to a 3” height and until acceptance. Seeded areas will require the application of herbicides to kill broadleaf and grassy weeds. A fertilizer application of 23-3-8 at a rate of one pound actual N per 1,000 square feet shall be applied. When this operation is completed, no heavy objects shall be moved over or placed upon these areas at any time unless protected in a manner approved by the Owner’s Representative.

1.5.3.5 The turf grass seeding rates are as follows:

1.5.3.5.1 Improved Bluegrass mixture: 2 - 3 pounds per 1000 square feet.

1.5.3.5.2 Improved Turf-Type Tall Fescue mixture: 7 - 8 pounds per 1000 square feet.

1.5.3.5.3 Kentucky 31 Tall Fescue Mixture: 6 - 8 pounds per 1000 square feet.

1.5.3.6 The turf mixture for each area shall be divided into two equal parts, each to be broadcast in a separate operation with the second seeding to be over the first and at right angles to it. Seed shall be uniformly distributed with a “brilliontype,” cultipacker seeder, rotary fertilizer spreader, or other approved mechanical seeding equipment. A grain seed drill shall be used. Hydroseeding will not be accepted. After placement of seed, the seedbed shall be scarified to an average depth of ¼” and raked to incorporate the seed into the soil to insure good seed/soil contact. A drill or slicer seeder is recommended to seed grasses – allows seed to come into contact with soil.

1.5.3.7 Straw mulch shall be broadcast evenly, 4 to 5 straws deep, with a straw blower over the seeded areas using not less than 1 bale per 1000 square feet. Approximately 50% of the soil surface shall show through the mulch. In lieu of broadcasting the straw blower, the mulch shall be anchored to the soil by light disking, or other approved method, which will secure the
straw firmly in the ground to form a soft binding mulch and prevent loss or bunching by the wind.

1.5.3.8 All slopes equal to or greater than one vertical foot to three horizontal feet, or areas of concentrated surface storm water drainage (i.e. drainage channels) shall be covered with erosion control fabric after seeding. Staple the 6" overlap of erosion control fabric at a minimum of every 24 inches.

1.5.4 Planting of Turf Areas – Sodding

1.5.4.1 All areas to be sodded are indicated on the Drawings.

1.5.4.2 The sodding operation shall not commence until site conditions are satisfactory. Sodding shall not be done when the ground is excessively wet, frozen or untillable.

1.5.4.3 All areas to be sodded shall meet the specified finish grades before sodding and be free of deleterious materials, including weeds, existing grasses, tree branches, oil drippings, stones greater than 1-1/2" diameter, concentrations of crushed rock, mortar and other loose building materials. Finish grade shall consist of a minimum 6" layer of topsoil except where greater thicknesses are noted on the Drawings. Grades for the flow lines of swales and ditches, detailed on the Drawings, shall be carefully established at a level even with the thatch surface of the sod. Sod placement, rolling, and watering shall conform with the grades shown on the Drawings.

1.5.4.4 Prepare sod bed by applying slow release fertilizer with ratios of approximately 10-18-22, supplemented with iron, at a rate of one pound actual N per 1,000 square feet of area to be sodded. The fertilizer shall be thoroughly incorporated into the soil by tilling to a depth of 4 to 6 inches with a mechanical tiller or other approved method. The sod bed is to be smooth, free of rocks, clods and other debris larger than one inch; and free from hollows or depressions. Sod bed shall be in a firm, but uncompacted condition with a fine texture prior to laying of sod.

1.5.4.5 Sod shall be installed in tightly abutted parallel rows with the lateral joints staggered at a minimum distance equal to the width of the sod slab. Voids between sod strips will not be accepted.

1.5.4.6 For sloping surfaces, sod shall be laid at the base of the slope with staggered joints and at right angles to the flow of water. Sod placed on 3:1 slopes or steeper, and in ditch flow lines, shall be staked with 6 stakes per square yard or roll of sod. Stakes shall be wood, with 1/2" of the top above sod line. Stakes should be set sufficiently in the ground to permit mowing.

1.5.4.7 The sod shall be watered immediately after installation. Prevent sod from drying during progress of work. After sodding is completed in any one section, the entire area shall
be thoroughly irrigated to at least one-inch depth below the new sod pad. Subsequent watering should maintain moisture to a depth of at least 4 inches.

1.5.4.8 Maintenance shall begin immediately after planting. The sod shall be protected and maintained by watering, mowing, fertilizing and replanting for as long as it is necessary to establish a uniform stand of grass. Any sod not surviving prior to its first mowing shall be replaced with new sod from the same source. Mowing of the sod will be the responsibility of the Owner.

1.5.5 Maintenance of Turf

1.5.5.1 Seeded Turf Areas: The Contractor shall protect seeded areas by watering, mowing, fertilizing, applying herbicide, and replanting as necessary for as long as is required to establish a uniform stand of grass to a 3” height and until acceptance. Seeded areas will require the application of herbicides to kill broadleaf and grassy weeds. A fertilizer application of 23-3-8 at a rate of one pound actual N per 1,000 square feet shall be made in April of the following year. Scattered bare spots, (none of which are larger than one square foot) will be allowed in up to a maximum of five percent of any planted area. The Contractor is to supply water by hoses and sprinkler equipment as needed until acceptance of the seeded areas.

1.5.5.2 Sodded Turf Areas: The maintenance shall begin immediately after planting. The sod shall be protected and maintained by watering, mowing, fertilizing and replanting for a minimum of 21 days or as long as necessary to establish a uniform stand of grass. Any sod not surviving shall be replaced by new sod from the same source. A fertilizer application of 28-3-8 at a rate of one pound actual N per 1,000 square feet of sod shall be made in April of the following year. The Contractor is to supply water by hoses and sprinkler equipment as needed until acceptance of the sodded areas.

1.5.6 Relocation of Existing Trees and Shrubs

1.5.6.1 Trees and shrubs to be relocated shall be balled and burlapped (B & B) according to accepted nursery industry standards. Plants shall be dug with firm natural balls of earth in a diameter not less than specified by “American Standard for Nursery Stock,” ANSI Z60.1 and shall be securely wrapped with burlap or canvas, and tightly bound with rope or wire.

1.5.6.2 Trees and shrubs shall be immediately replanted or heeled-in after digging in accordance with the specifications.

1.5.7 Installation of Landscape Bed Edging (Wood Timbers)

1.5.7.1 Place Edging in areas and with dimensions indicated on the Drawings.
1.5.7.2 Installed edging shall be flush with the finish grade of the adjacent turf area and ½” above the mulched bed.

1.5.7.3 Anchor edging with reinforcing rod stakes spaced not more than 3 feet on center and driven at least 24 inches into the subgrade. Stakes shall be placed in the holes that are drilled on center with the timber edging. Four galvanized nails shall be used per wood “connector strip.”

1.5.8 Clean-Up and Protection

1.5.8.1 Site Cleaning

1.5.8.1.1 Pick up litter within project site and any litter within 50 feet of the University’s side of the project site fence, along access routes, Contractor storage yards and parking area, on a daily basis. Debris to be placed in Contractor’s trash containers. Contractor is responsible for all removal of construction debris.

1.5.8.1.2 Keep weeds and grasses in control every five days within project site and in Contractor parking/storage yards (use weed eater or mower for cutting.)

1.5.8.1.3 Contractor is to use planking, or other protective measures.

1.5.8.1.4 Contractor is to clean concrete trucks within the project site or off campus property.

1.5.8.1.5 On a daily basis, power wash streets and sidewalks after Contractor’s vehicles have left tracks on the way to or from the project site. Spud hoe up clods of dirt thrown from or crushed by tires, etc. and remove from site. Street sweep access routes used by contractors to edge of campus as well as provide follow up cleaning; i.e. broom and wash.

1.5.8.1.6 On a daily basis, remove stains from paved surfaces caused by rubber from tire tracks, oils, fuels, solvents, etc.

1.5.8.2 Site Access – The campus is a pedestrian campus and must remain accessible for the safe movement of pedestrians through the entire campus.

1.5.8.2.1 Contractor shall provide alternate or temporary sidewalks to keep people moving, with adequate surfaces for safety.

1.5.8.2.2 Contractor is to use boring methods to pass utility lines under and keep all paved areas intact to the greatest extent possible.

1.5.8.2.3 Contractor must share sidewalks and streets with pedestrians and other service vehicles along their access route to their project site boundaries.
1.5.8.2.4 Alternate traffic methods need to comply with all applicable codes and regulations.

1.5.8.2.5 ADA accessibility must be maintained.

1.5.8.2.6 Required fire exit paths from buildings must be maintained with a hard surface and never be blocked by Contractor equipment, materials or work at any time during the work day.

1.5.8.2.7 Access to site for University personnel or other Contractors must be maintained at all times.

1.5.8.2.8 Contractor is to remove construction debris from site on a daily basis, or keep debris fully enclosed in commercial containers.

1.5.8.2.9 Contractor may use sidewalks/streets for limited access to site, provided:

  1.5.8.2.9.1 When the ground is moist, planking is required along the path of access to prevent construction vehicle damage to grounds.

  1.5.8.2.9.2 Contractor Personnel shall direct pedestrian traffic for safety purposes adjacent to project site when heavy equipment needs access to and from project site across sidewalks/streets.

1.5.8.2.10 Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.

1.5.8.2.11 Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

1.5.8.2.12 Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner’s property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

  1.5.8.2.12.1 Where extra materials of value remain after completion of associated Work, they become the Owner’s property. Dispose of these materials as directed by the Owner.

1.5.9 Plant Guarantee and Maintenance Requirements
1.5.9.1 At the end of the guarantee period, inspection will be made by the Owner upon written notice requesting such inspection submitted by the Contractor at least 10 days prior to the anticipated date. Any and all parts which prove defective in material or workmanship shall be replaced by the Contractor at their expense.

1.5.9.2 During construction time up to the date of Partial Occupancy as approved by the Owner, any plants missing due to theft or vandalism shall be replaced by the Contractor at their expense as soon as conditions permit during the normal planting season. Normal fall planting season shall be from September 1 to October 31 for seeding, sodding, shrub, perennial, bulb and groundcover planting in the Fall. Tree planting may continue until December 15, weather permitting. Normal spring planting season shall begin when weather permits or soil conditions are suitable until May 24.

1.5.9.3 Any plant material required under this Contract that is not in satisfactory vigor and growth at the end of the guarantee period for any reason except hail, flood, tornado, fire, earthquake, and/or Owner damage, as determined by the Owner, shall be removed from the site. These plants and any plants missing because of the Contractor’s negligence shall be replaced by the Contractor at their expense as soon as conditions permit during the normal planting season. In case of a rejected plant, the Contractor may elect, upon agreement by the Owner, to allow such plant to remain through another complete growing season. The rejected plant, if found not to be in healthy or vigorous growing condition after another growing season, shall be replaced by the Contractor, in a larger than specified size if necessary, to match other plants in a particular bed or planting group planted under this contract.

1.5.9.4 All replacements shall be plants of the same kind as specified in the plant list. They shall be furnished and planted as specified under planting of trees, shrubs, perennials, bulbs, and groundcovers and the cost shall be borne by the Contractor.

1.6 Lawn Sprinkler Piping

1.6.1 Materials

1.6.1.1 PVC and PVC Pipe Fittings

1.6.1.1.1 Mainline pipe shall be virgin, high impact, polyvinyl chloride (PVC) Schedule 40. Lateral lines shall be polyvinyl chloride (PVC) pipe Class 200 or specified P.E. pipe. All PVC pipe shall be continuously and permanently marked with manufacturer’s name, material, size and schedule or type. Pipe shall meet ASTM D2241 specifications for PVC plastic pipe or latest revision thereof. Pipe sizes are shown on
drawings as minimum allowable sizes. Larger sizes may be used by Contractor.

1.6.1.2 P.E. Pipe and P.E. Pipe Fittings

1.6.1.2.1 For lateral lines, of sizes shown below, the installer may use polyethylene pipe (P.E.) Class 160. Pipe sizes on drawings shall be adjusted to the following sizes for P.E. pipe:

<table>
<thead>
<tr>
<th>PVC</th>
<th>P.E.</th>
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<tbody>
<tr>
<td>1”</td>
<td>1 – ½”</td>
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<tr>
<td>1 – ½”</td>
<td>2”</td>
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</tbody>
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1.6.1.3 Flexible Swing Pipe or Triple Swing Joint

1.6.1.3.1 Flexible swing pipe shall be ½” polyethylene (P.E.) pipe, Class 160. The flexible pipe should not extend over 3 feet and should be placed to provide positive drainage to the lateral line.

1.6.1.3.2 Fittings for the flexible swing pipe shall be the ‘spiral barb’ type, as specified for P.E. pipe and clamps.

1.6.1.3.3 Use a triple swing joint on lateral pipe sizes 2” or larger.

1.6.1.3.4 Use flexible swing polyethylene pipe on laterals of sizes less than 2”.

1.6.1.4 Pipe and Tube Fittings

1.6.1.4.1 All PVC fittings shall be schedule 40 and 80: ASTM D 2466.

1.6.1.4.2 Insert fittings for P.E. Pipe: Fittings shall be held in place on the pipe with screw tightened stainless steel clamps fastened around the fitting serration.

1.6.1.5 Joining Materials

1.6.1.5.1 All slip fittings shall be solvent welded. Primer is to be a different color than cement.

1.6.1.5.2 Use Teflon tape on all threaded fittings, applied with a single wrap with 50% overlap.

1.6.1.6 Valves and valve specialities

1.6.1.6.1 Remote control valve shall be Weathermatic 11000 CR series with pressure regulator.

1.6.1.6.2 Master valves shall be Weathermatic 8000 CR or 11000 CR series.
1.6.1.6.3 Flow sensor shall be a model supplied by Data Industrial, or approved equal, with a schedule 80 PVC tee and fitted with a removable sensor insert.

1.6.1.6.4 Remote Control Valves for flows less than 10 G.P.M. shall be Rainbird XCZ-075 prepackaged control zone kit including (1) XBV-075 ball valve, (1) RBY-075-200 MX inline filter, (1) 75-DVX remote control valve, (1) PSI-M30X pressure regulator, (2) ¾" (20/27) x 1½" schedule 80 nipples.

1.6.1.6.5 R.C.V. valve box cover shall be green in color.

1.6.1.6.6 Sprinklers shall be Hunter (gear, pop-up). Strip head sprinklers shall be Hunter, Toro, Rainbird.

1.6.1.6.7 Use double check assembly for checking the water in underground vault.

1.6.1.7 Wiring

1.6.1.7.1 Wire to the automatic controller from the power source shall be copper conductor, No. 12 AWG Type-TW or THHN wire.

1.6.1.7.2 Electric control wires from the automatic controller to the automatic valves shall be direct burial No. 14 AWG copper, UF Type wire. The insulation shall be 60° Celsius with insulation thickness of 3/64". The common wire shall be white and another individual color shall be dedicated to each valve. Extra wires shall be installed as shown on plan and as herein specified with ends properly water proofed with King ‘one-step’ connectors or approved equal.

1.6.1.7.3 Wires used above ground shall be encased in U.L. listed electrical metallic tubing attached to the vertical mounting surface with zinc plated clips placed two feet on center.

1.6.1.7.4 Wires beneath sidewalks or roads shall be installed in a P.V.C. sleeve.

1.6.1.8 Automatic Control System

1.6.1.8.1 Controller shall be Eicon wall or pedestal mount enclosure that is waterproof & lockable. Ground according to manufacturer’s recommendations.

1.6.2 Execution

1.6.2.1 Preparation

1.6.2.1.1 Flags shall be set to identify preliminary locations of lawn sprinklers.
1.6.2.2 Trenching and Backfilling

1.6.2.2.1 Sleeves for piping and wiring shall be installed under sidewalks.

1.6.2.2.2 Piping or sleeves shall be covered to these minimums:

1.6.2.2.2.1 Lateral Pipe – 18 inches, Class 200 P.V.C.

1.6.2.2.2.2 Mainline Pipe – 28 inches, Schedule 40 P.V.C.

1.6.2.2.2.3 Sleeves – 28 inches or 18 inches, Schedule 40 P.V.C.

1.6.2.3 Piping Installation

1.6.2.3.1 Install P.V.C. pipe in dry weather at temperatures above 40 degrees Fahrenheit for 24 hours at this temperature before testing.

1.6.2.4 Automatic Control System Installation

1.6.2.4.1 Wiring should be installed in same trench with piping. To allow for expansion, loop wire at control valves and controllers and 100 foot intervals. Bundle wires every 10 feet.

1.6.2.4.2 Pipe shall be flushed free of dirt and debris before installation of sprinklers or other devices.

1.6.2.4.3 Test entire system at normal working pressure for 3 hours and demonstrate operation to Owner’s maintenance personnel.

1.6.2.4.4 The specification standards listed herein are designed for potable water lawn irrigation application only. Chemical injection and reclaimed water through irrigation piping is not permitted.

End of Section
Appendix 2 Energy Conservation Policies

2.1 Policy # 010: Building Envelope

2.1.1 Purpose
2.1.2 Reference Codes and Standards
2.1.3 General
2.1.4 Building Envelope Thermal Transmittance Values
2.1.5 Building Envelope Air Leakage Criteria

2.2 Policy # 020: Heating, Ventilating and Air Conditioning

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2.2.2 Reference Codes and Standards
2.2.3 General
2.2.4 Calculation of Heating and Cooling Loads
2.2.5 HVAC Systems
2.2.6 HVAC Equipment
2.2.7 HVAC Controls

2.3 Policy # 030: Air Conditioning Equipment

2.3.1 Purpose
2.3.2 Reference Codes and Standards
2.3.3 General
2.3.4 Selection of Equipment
2.3.5 Minimum Equipment Efficiencies

2.4 Policy #040: Energy Management Control Systems

2.4.1 Purpose
2.4.2 Reference Codes and Standards
2.4.3 General
2.4.4 Connected Equipment
2.4.5 System Description

2.5 Policy #050: Building Hot Water Systems

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2.5.2 Reference Codes and Standards
2.5.3 General
2.5.4 Domestic Water Heating Equipment
  2.5.4.1 Centralized
  2.5.4.2 Distributed
2.5.5 Insulation of Storage Tanks and Piping Systems
2.5.6 Domestic Hot Water Controls

2.6 Policy #060: Building Lighting and Electrical Systems

2.6.1 Purpose
2.6.2 Reference Codes and Standards
2.6.3 General
2.6.4 Interior Lighting
2.6.4.1 General
  2.6.4.1.1 Interior Lighting Systems
  2.6.4.1.2 Lighting Power Budget Limits
2.6.4.2 Lamps
  2.6.4.2.1 Maximum Use
  2.6.4.2.2 General Lighting
  2.6.4.2.3 Compact Fluorescents
  2.6.4.2.4 Exit Signs
2.6.4.3 Controls
  2.6.4.3.1 All Rooms
  2.6.4.3.2 Individual Controls
  2.6.4.3.3 Motion Sensors
  2.6.4.3.4 Dimming Systems
2.6.5 Exterior Lighting
  2.6.5.1 General
    2.6.5.1.1 Exterior Lighting Systems
    2.6.5.1.2 Power Budget Limits
  2.6.5.2 Lamps
    2.6.5.2.1 Metal-Halide Lamps
  2.6.5.3 Controls
    2.6.5.3.1 Primary Control System
2.6.6 Electrical Equipment and Systems
  2.6.6.1 Electric Motors
    2.6.6.1.1 Efficiency Requirements
    2.6.6.1.2 Motors Not Covered
    2.6.6.1.3 Variable Speed Drives

2.7 Policy #070: Operations and Maintenance

  2.7.1 Purpose
  2.7.2 Reference Codes and Standards
  2.7.3 General
  2.7.4 Temperature and Humidity Standards
    2.7.4.1 Space Cooling
    2.7.4.2 Personnel Comfort
    2.7.4.3 Inside Temperatures
    2.7.4.4 Unoccupied Periods
  2.7.5 Maintenance Activities
    2.7.5.1 General
      2.7.5.1.1 Energy Issues
      2.7.5.1.2 Repair
      2.7.5.1.3 Repair
      2.7.5.1.4 Report
    2.7.5.2 Building Envelope
      2.7.5.2.1 Caulking
      2.7.5.2.2 Maintain
      2.7.5.2.3 Maintain
      2.7.5.2.4 Maintain
    2.7.5.3 Electrical
      2.7.5.3.1 Lights
      2.7.5.3.2 Replace Lamps
      2.7.5.3.3 Replace Ballasts
      2.7.5.3.4 Maintain Photocells
      2.7.5.3.5 Lighting
2.7.5.3.6 Lubricate
2.7.5.3.7 Bad Bearings
2.7.5.3.8 Failed Motors
2.7.5.3.9 VSDs
2.7.5.3.10 New Applications

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2.7.5.4.1 Leaks
2.7.5.4.2 Cleaning
2.7.5.4.3 Bad Bearings
2.7.5.4.4 Worn Belts
2.7.5.4.5 Insulation
2.7.5.4.6 Filters
2.7.5.4.7 HVAC Field Controls
2.7.5.4.8 Seals
2.7.5.4.9 Time Clocks

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2.7.5.5.1 Minimize Fouling
2.7.5.5.2 Clean Tubes
2.7.5.5.3 Refrigerant Leaks
2.7.5.5.4 Blowdown
2.7.5.5.5 Proper Operation
2.7.5.5.6 Daily Log

2.7.5.6 Steam, Condensate and Hot Water
2.7.5.6.1 Leaks
2.7.5.6.2 Inspection Program
2.7.5.6.3 Insulation
2.7.5.6.4 Insulation
2.7.5.6.5 Valves
2.7.5.6.6 Receivers and Pumps
2.7.5.6.7 Check Valves
2.7.5.6.8 Efficiency
2.7.5.6.9 Relief Valves

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2.7.5.7.1 Minimizing
2.7.5.7.2 Minimize Water Use
2.7.5.7.3 Repair Water Leaks
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Appendix 2    Energy Conservation Policies

2.1 Policy #: 010

Title: BUILDING ENVELOPE

2.1.1 Purpose:
To provide criteria for design that will produce energy savings when applied to building envelope systems.

2.1.2 Reference Codes and Standards:
UBC Uniform Building Code
ASHRAE Standard 90.1
ASHRAE Standard 100

2.1.3 General:
Building envelope systems will be designed in a manner conducive to saving energy. Building envelope systems
will be designed in accordance with Uniform Building Code, ASHRAE Standard 90.1 or ASHRAE Standard
100.

2.1.4 Building Envelope Thermal Transmittance Values:
Thermal transmittance values (U) as determined from ASHRAE Standard 90.1 (Table 8A-29) will be used as
basic building envelope criteria. The value of 5046 heating degree days base 65°F will be used for buildings
located on the KSU campus.

As a guideline, the maximum allowable overall transmittance value (U) for roof/ceilings will be 0.05 (R=2.2).
The maximum percent fenestration will be 35% of total wall area.

2.1.5 Building Envelope Air Leakage Criteria:
Air leakage through windows and doors will comply with ASHRAE Standard 90.1, ASHRAE Standard 100 or
the following requirement, whichever is more stringent.

Windows will be selected to limit air leakage to less than 0.37 Ft³/minute per foot of sash crack. Swinging,
revolving or sliding doors will be selected to limit air leakage to less than 1.25 Ft³/minute per square foot of door
area. Window and door air leakage rates will be based on a 25 mph wind speed.
Title: HEATING, VENTILATING AND AIR CONDITIONING

2.2.1 Purpose:
To provide criteria for design and equipment selection that will produce energy savings when applied to building heating, ventilating and air conditioning systems.

2.2.2 Reference Codes and Standards:
UBC Uniform Building Code
ASHRAE Handbooks
ASHRAE Standard 90.1
ASHRAE Standard 100

2.2.3 General:
Building heating, ventilating and air conditioning systems will be selected and designed in a manner conducive to saving energy. Building heating, ventilating and air conditioning systems will be designed in accordance with Uniform Building Code, ASHRAE Handbooks, ASHRAE Standard 90.1, or ASHRAE Standard 100.

2.2.4 Calculation of Heating and Cooling Loads:
For personnel comfort systems in buildings located in the KSU Campus, HVAC system calculations will use a winter outdoor design condition of -1°F dry bulb (99% value) and a summer outdoor design temperature will be 94°F dry bulb (2% value), 74°F wet bulb (2% value). Heating indoor design temperature will be 72°F and cooling indoor design temperature will be 78°F.

For spaces requiring close temperature or humidity control, the design professional will base the calculations on ASHRAE recommendations.

2.2.5 HVAC Systems:
Variable air volume systems will be installed whenever possible.

Double duct, multizone and constant volume reheat systems will not be used unless justified.

Zones with special process temperature requirements, humidity requirements, or both, will be served by separate air distribution systems.

Off-hour controls will be provided on all HVAC systems that are not required to operate continuously. Small systems (<2kW) are exempt. Control sequence will include a warm-up cycle that speeds warm-up of the spaces while minimizing energy input.

Economizer cycles will be provided on all systems. Full outside air dampers will be used.

Temperature reset controls will be provided for mixed air control, supply air control and hot water distribution, when economically justified.

Laboratories with fume hoods will include face velocity controls to vary the supply and exhaust air flows, when economically justified.

Variable speed drive systems will be used on pumps and fans larger than 10HP, when economically justified.

Pipe insulation and duct insulation will meet or exceed the minimum values contained in ASHRAE Standard 90.1 or ASHRAE Standard 100. As a guideline the following pipe Insulation Table and Duct Insulation Table may be used.
## MINIMUM PIPE INSULATION

<table>
<thead>
<tr>
<th>System Type</th>
<th>Fluid Temperature Range</th>
<th>Runouts</th>
<th>Branches, Mains, and Loops</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&lt;=1</td>
</tr>
<tr>
<td>Fluid Heating:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td>351-450</td>
<td>11/2&quot;</td>
<td>21/2&quot;</td>
</tr>
<tr>
<td>Steam Condensate</td>
<td>251-350</td>
<td>11/2&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>Hot Water</td>
<td>141-250</td>
<td>1&quot;</td>
<td>11/2&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid Cooling:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chilled water, brine</td>
<td>40-55</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>Below 40</td>
<td>1&quot;</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

Insulation thicknesses are based on insulation having an R-value in the range between R-4.0 and R-4.6 per inch. For other R-values, insulation thickness may be adjusted as follows:

For R-value > 4.6: Thickness = 4.6 x table thickness/actual R-value
For R-value < 4.0: Thickness = 4.0 x table thickness/actual R-value

## MINIMUM DUCT INSULATION

<table>
<thead>
<tr>
<th>Duct Location</th>
<th>Cooling Minimum R-value</th>
<th>Heating Minimum R-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior of Building</td>
<td>6.5</td>
<td>6.5</td>
</tr>
<tr>
<td>Inside of Building Envelope or in unconditioned spaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temp. Diff &lt; 15°</td>
<td>none required</td>
<td>none required</td>
</tr>
<tr>
<td>15° &lt; Temp. Diff &lt; 40°</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>40° &lt; Temp</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

2.2.6 HVAC Equipment:
All HVAC equipment will be selected to comply with the efficiency requirements contained in ASHRAE Standard 90.1, ASHRAE Standard 100 or Air Conditioning Equipment Energy Conservation Policy 030, whichever is more stringent.

2.2.7 HVAC Controls:
HVAC controls will be designed to comply with the requirements in ASHRAE Standard 90.1 or ASHRAE Standard 100.

Direct digital control system will be installed on systems meeting the requirements in the Energy Management Control System Energy Conservation Policy 040.
2.3 Policy #: .30

Title: AIR CONDITIONING EQUIPMENT

2.3.1 Purpose:
To provide criteria for equipment selection of air conditioning equipment that will produce energy savings when applied to building heating, ventilating and air conditioning systems.

2.3.2 Reference Codes and Standards:
- UBC Uniform Building Code
- ASHRAE Handbooks
- ASHRAE Standard 90.1
- ASHRAE Standard 100

2.3.3 General:
Air conditioning equipment will be selected in a manner conducive to saving energy. Air conditioning equipment will be selected in accordance with Uniform Building Code, ASHRAE Handbooks, ASHRAE Standard 90.1, or ASHRAE Standard 100.

2.3.4 Selection of Equipment:
The selection of air conditioning equipment will be based on performance at full load and part load conditions. Systems consisting of multiple pieces of equipment in a single location will be operated in a manner that maximizes the overall system efficiency.

All air conditioning equipment will meet the minimum equipment efficiency contained in this policy.

Air conditioning equipment will be selected based on the lowest life cycle cost. Air conditioning equipment larger than 100 tons will be water-cooled. Air conditioning equipment larger than 200 tons will be selected based on consideration of its impact on the University's central power plant and lowest life cycle cost.

2.3.5 Minimum Equipment Efficiencies:
Use of heat pumps on KSU projects has not been encouraged. However, off-campus projects may be considered on a case-by-case basis. Heat pumps will have a coefficient of performance (COP) or heating seasonal performance factor HSPF for heating and will have a seasonal energy efficiency ratio (SEER) or energy efficiency ratio (EER) for cooling not less than the values shown below.
<table>
<thead>
<tr>
<th>Category</th>
<th>Air Source (at 47° db)</th>
<th>Water Source (at 70° db)</th>
<th>Groundwater (At 50° db)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Phase</td>
<td>Three Phase</td>
<td>Single Phase</td>
</tr>
<tr>
<td>&lt;65,000 Btu/hr Heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split System</td>
<td>6.8 HSPF</td>
<td>6.8 HSPF</td>
<td>3.8 COP</td>
</tr>
<tr>
<td>Single Packaged System</td>
<td>6.6 HSPF</td>
<td>6.6 HSPF</td>
<td>3.8 COP</td>
</tr>
<tr>
<td>Cooling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split System</td>
<td>10.0 SEER</td>
<td>10.0 SEER</td>
<td>9.3 EER</td>
</tr>
<tr>
<td>Single Packaged System</td>
<td>9.7 SEER</td>
<td>10.0 SEER</td>
<td>9.3 EER</td>
</tr>
<tr>
<td>&gt;= 65,000 Btu/hr Heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;= 135,000 Btu/hr Heating</td>
<td>3.0 COP</td>
<td>3.0 COP</td>
<td>3.8 COP</td>
</tr>
<tr>
<td>Cooling</td>
<td>8.9 EER</td>
<td>8.9 EER</td>
<td>10.5 EER</td>
</tr>
<tr>
<td>&gt;= 135,000 Btu/hr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating</td>
<td>2.9 COP</td>
<td>2.9 COP</td>
<td>3.0 COP</td>
</tr>
<tr>
<td>Cooling</td>
<td>8.5 EER</td>
<td>8.5 EER</td>
<td>7.5 EER</td>
</tr>
</tbody>
</table>

Packaged terminal air conditioners will have an energy efficiency ratio (EER) for cooling not less than the values shown below. Packaged terminal heat pumps will have a coefficient of performance (COP) for heating and will have an energy ratio (EER) for cooling not less than the values shown below.
### PACKAGED TERMINAL AIR CONDITIONER AND HEAT PUMPS MINIMUM PERFORMANCE

<table>
<thead>
<tr>
<th>Size</th>
<th>Heating (COP @ 47°F)</th>
<th>Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 7,500 Btu/hr</td>
<td>2.7 COP</td>
<td>8.9 EER</td>
</tr>
<tr>
<td>≥ 7,500 Btu/hr, &lt; 10,000 Btu/hr</td>
<td>2.7 COP</td>
<td>8.6 EER</td>
</tr>
<tr>
<td>≥ 10,000 Btu/hr, &lt; 13,000 Btu/hr</td>
<td>2.7 COP</td>
<td>8.01 EER</td>
</tr>
<tr>
<td>&gt; 13,000 Btu/hr</td>
<td>2.7 COP</td>
<td>7.7 EER</td>
</tr>
</tbody>
</table>

Central air conditioners will have an energy efficiency ratio (EER) or seasonal energy efficiency ratio (SEER) for cooling not less than the values shown below.

### CENTRAL AIR CONDITIONERS MINIMUM PERFORMANCE

<table>
<thead>
<tr>
<th>Category</th>
<th>Under 65,000 Btu/hr</th>
<th>65,000 Btu/hr to 13,500 Btu/hr</th>
<th>Greater than 135,000 Btu/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Phase</td>
<td>Three Phase</td>
<td></td>
</tr>
<tr>
<td>Air Cooled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split System</td>
<td>10.0 SEER</td>
<td>10.0 SEER</td>
<td>8.9 EER</td>
</tr>
<tr>
<td>Single Packaged System</td>
<td>9.7 SEER</td>
<td>10.0 SEER</td>
<td>8.9 EER</td>
</tr>
<tr>
<td>Water or Evap. Cooled</td>
<td>9.3 SEER</td>
<td>9.3 SEER</td>
<td>10.5 EER</td>
</tr>
</tbody>
</table>

APP-2-13
January 2013
Electrically driven water chillers will have an energy efficiency ratio (EER) for cooling not less than the values shown below.

<table>
<thead>
<tr>
<th>ELECTRIC CHILLERS</th>
<th>MINIMUM PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td><strong>Air</strong></td>
</tr>
<tr>
<td>With Condenser</td>
<td></td>
</tr>
<tr>
<td>&gt;= 300 tons</td>
<td>8.5 EER</td>
</tr>
<tr>
<td>&lt; 300 tons and &gt;= 150 tons</td>
<td>8.5 EER</td>
</tr>
<tr>
<td>&lt; 150 tons</td>
<td>9.2 EER</td>
</tr>
<tr>
<td>Without Condenser</td>
<td></td>
</tr>
<tr>
<td>All sizes</td>
<td>10.6 EER</td>
</tr>
</tbody>
</table>

Electrically driven condensing units 65,000 Btu/hr and over will have an energy efficiency ratio (EER) for cooling not less than the values shown below.

<table>
<thead>
<tr>
<th>CONDENSING UNITS 65,000 Btu/hr AND OVER</th>
<th>MINIMUM PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td><strong>Minimum Performance</strong></td>
</tr>
<tr>
<td>Air</td>
<td>9.9 EER</td>
</tr>
<tr>
<td>Water/Evaporative</td>
<td>12.9 EER</td>
</tr>
</tbody>
</table>

Heat Operated cooling equipment will have a coefficient of performance (COP) for cooling not less than the values shown below. These requirements apply to absorption equipment, engine driven equipment and turbine driven equipment.

<table>
<thead>
<tr>
<th>HEAT OPERATED COOLING EQUIPMENT</th>
<th>MINIMUM PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heat Source</strong></td>
<td><strong>Minimum Performance</strong></td>
</tr>
<tr>
<td>Indirect Fired (Steam, Hot Water)</td>
<td>0.68 COP</td>
</tr>
</tbody>
</table>
2.4 Policy #: 040

Title: ENERGY MANAGEMENT CONTROL SYSTEMS

2.4.1 Purpose:
To provide criteria for design and equipment selection that will produce energy savings when applied to energy management control systems.

2.4.2 Reference Codes and Standards:
ASHRAE Standard 90.1
ASHRAE Standard 100
ASHRAE Standard 114

2.4.3 General:
Building energy management control systems will be selected and designed in a manner conducive to saving energy. Energy management control systems will be designed in accordance with ASHRAE Standards.

2.4.4 Connected Equipment:
Building energy consuming equipment will be controlled by a computerized energy management control system where economically feasible. The individual controllers will be connected to the site wide network in order to provide central control, monitoring, reporting and energy saving functions.

As a minimum, the following systems will be connected to an energy management control system:

- > 10,000 CFM air handling units with return air
- > 5,000 CFM air handling units with 100% outside air
- > 5,000 CFM or > 5 HP fans
- > 150 GPM or > 5 HP pumps
- > 100 Ton chiller/cooling tower operating seasonally
- > 50 Ton chiller/cooling tower operating year round
- > 25 HP compressors
- All constant volume terminal reheat boxes
- > 10 HP variable speed drives
- All snow melting systems
- All central units 2 tons or larger

2.4.5 System Description:
The current energy management control system standard for the main and Vet Med Campuses is the Honeywell Control System. On the main campus Student Housing uses a different EMS system, the Johnson Control System. Other EMS equipment will not be used.
2.5 Policy #: 050

Title: BUILDING HOT WATER SYSTEMS

2.5.1 Purpose:
To provide criteria for design and equipment selection that will produce energy savings when applied to
domestic water heating.

2.5.2 Reference Codes and Standards:
- UBC Uniform Plumbing Code
- ASHRAE Handbooks
- ASHRAE Standard 90.1
- ASHRAE Standard 100

2.5.3 General:
Domestic hot water shall be generated and delivered in a manner conducive to saving energy and conserving
water. Domestic hot water systems will be designed in accordance with Uniform Plumbing Code, ASHRAE
Handbooks, ASHRAE Standard 90.1 or ASHRAE Standard 100.

2.5.4 Domestic Water Heating Equipment:
Hot water will be supplied by one of the following methods:

2.5.4.1 For centralized domestic hot water systems where steam is available, hot water will be generated in a
steam fired heat exchanger and stored in an insulated storage tank. Where steam is not readily
available, gas or electric may be used, if economically justified. Entering water will be softened when
economically justified.

2.5.4.2 For distributed domestic hot water systems where steam is available, hot water will be generated in
steam fired instantaneous water heaters. Where steam is not readily available, gas or electric
instantaneous water heaters or small storage heater may be used, if economically justified. If
instantaneous water heaters are used, entering water will be softened.

Where temperatures higher than 120°F are required at certain outlets for a particular intended use, separate
remote heaters or booster heaters will be installed for those outlets.

Departmental users that require continuous hot water will insure that their booster heaters can provide all of their
needs.

2.5.5 Insulation of Storage Tanks and Piping Systems:
Unfired hot water storage tanks will be insulated in accordance with the requirements in ASHRAE Standard 90.1
or ASHRAE Standard 100.

Fired hot water storage tanks will meet performance efficiencies published in ASHRAE standard 90.1 or
ASHRAE Standard 100.

Domestic hot water supply and recirculation piping will be insulated in accordance with the requirements in
ASHRAE Standard 90.1, ASHRAE Standard 100, Uniform Plumbing Code or the Minimum Pipe Insulation
Table in Energy Conservation Policy 020, whichever is more stringent.

2.5.6 Domestic Hot Water Controls:
Lavatories in restrooms will be equipped with water saving fixtures that meet the requirements of ASHRAE Standard 90.1 or ASHRAE Standard 100.

Showers will be equipped with water saving shower heads that meet the requirements of ASHRAE Standard 90.1, or ASHRAE Standard 100. As a guideline, maximum discharge of hot water will be 0.50 gpm, or 0.75 gpm if a foot switch or occupancy sensor is used, or 2.50 gpm if a self closing valve is used.
2.6 Policy #: 060

Title: **BUILDING LIGHTING AND ELECTRICAL SYSTEMS**

2.6.1 Purpose:
   To provide criteria for design and equipment selection that will produce energy savings when applied to building electrical and lighting systems.

2.6.2 Reference Codes and Standards:
   - UBC Uniform Building Code
   - IES Lighting Handbook
   - ASHRAE Standard 90.1
   - ASHRAE Standard 100

2.6.3 General:
   Building electrical and lighting systems shall be selected and designated in a manner conducive to saving energy. Building electrical and lighting systems will be designed in accordance with Uniform Building Code, IES Lighting Handbook, ASHRAE Standard 90.1 or ASHRAE Standard 100.

2.6.4 Interior Lighting:

   2.6.4.1 General:
   - 2.6.4.1.1 Interior lighting systems will comply with the IES Lighting Handbook.
   - 2.6.4.1.2 For larger projects or where an Energy Conservation Study is required, the lighting power budget limits specified in ASHRAE Standard 90.1 or ASHRAE Standard 100 will be used to establish the maximum building lighting power that may be used for all permanently installed lighting within a building. The lighting power budget limit is expressed in watts per square foot and includes all power used by the lighting system including lamps, ballasts, current regulators and lighting controls.

   2.6.4.2 Lamps, Ballasts, and Fixtures:
   - 2.6.4.2.1 Maximum use will be made of florescent and HID lamps.
   - 2.6.4.2.2 T-8 fluorescent lamps and high efficiency, low harmonic electronic ballasts will be used for general lighting applications.
   - 2.6.4.2.3 Compact fluorescents will be used in lieu of incandescent where possible.
   - 2.6.4.2.4 Exit signs will have a lamp/ballast-combined wattage of no more than 35 watts.

   2.6.4.3 Controls:
   - 2.6.4.3.1 All rooms will have at least one accessible lighting control to activate general lighting within the room. Large rooms should have controls at each entrance.
2.6.4.3.2 All rooms larger than 500 square feet will have individual controls for rows of lights, so that general lighting may be reduced by at least one half throughout the room.

2.6.4.3.3 Motion sensors will be provided in rooms not intended for 24-hour continuous use, and will be capable of limiting the hours of lighting use to the occupancy hours of the room, where economically justified.

2.6.4.3.4 Dimming systems will be used where economically justified.

2.6.5 Exterior Lighting:

2.6.5.1 General:

2.6.5.1.1 Exterior lighting systems will comply with the IES Lighting Handbook.

2.6.5.1.2 The lighting power budget limits specified in ASHRAE Standard 90.1 or ASHRAE Standard 100 will be used to establish the maximum building exterior lighting power that may be used for all permanently installed exterior lighting systems. The lighting power budget limit is expressed in watts per square foot and includes all power used by the lighting system including lamps, ballasts, current regulators and lighting controls.

2.6.5.2 Lamps, Ballasts and Fixtures:

2.6.5.2.1 High efficiency metal-halide lamps will be used for exterior lighting.

2.6.5.3 Controls:

2.6.5.3.1 Exterior lighting systems will use photocells as the primary control system. Time clocks will be provided when additional savings can be achieved by limiting the hours of use to less than the hours of darkness.

2.6.6 Electrical Equipment and Systems:

2.6.6.1 Electric Motors:

2.6.6.1.1 All permanently wired AC polyphase induction motors that serve the building will meet the efficiency requirements of the following table. This includes:

- ☐ Motors with a nameplate rated horsepower of 1 HP or larger;
- ☐ Motors that are designed for continuous operation.

2.6.6.1.2 For motors not covered in paragraph a, “high efficiency” type motors will be used if economically justified.

2.6.6.1.3 Variable speed drives will be installed where motor speed requirements vary during normal operation and when economically justified.

<p>| MINIMUM NOMINAL FULL-LOAD |
| POWER FACTOR &amp; MOTOR EFFICIENCY |</p>
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January 2013
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2.7 Policy #: 070

Title: OPERATIONS AND MAINTENANCE

2.7.1 Purpose:
To provide requirements for the operation and maintenance of building equipment and systems to ensure the efficient use of energy.

2.7.2 Reference Codes and Standards:
- KSU Green Book (Verify cite)
- UBC Uniform Building Code
- ASHRAE Handbooks and Standards
- IES Lighting Handbook

2.7.3 General:
The University's facilities will be operated and maintained in a manner conducive to saving energy.

2.7.4 Temperature and Humidity Standards:

2.7.4.1 When space cooling is required for personnel comfort, the inside temperature will be maintained during occupied periods at 76°F ± 2°F dry Bulb. The relative humidity will be checked to assure it complies with the criteria bounds of ASHRAE Standard 55. Summer humidification will not be provided for personnel comfort.

2.7.4.2 For personnel comfort, the inside temperature for heating during occupied periods will be 72°F ± 2°F dry bulb.

2.7.4.3 Inside temperatures for heating other spaces will be maintained during occupied period as follows:

<table>
<thead>
<tr>
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<tr>
<td>Storage</td>
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<td>Toilets</td>
<td>70°F</td>
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<tr>
<td>Change Rooms</td>
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</tbody>
</table>

2.7.4.4 During unoccupied periods, space temperature will be allowed to fluctuate between 55°F and 90°F.

2.7.5 Maintenance Activities:

2.7.5.1 General:

2.7.5.1.1 Look for energy conservation issues during building visits.

2.7.5.1.2 Repair steam, condensate, compressed air and water leaks.

2.7.5.1.3 Repair or replace any malfunctioning energy conservation equipment.

2.7.5.1.4 Report any energy conservation opportunities to the Manager of Energy, Engineering for evaluation.

2.7.5.2 Building Envelope:

2.7.5.2.1 Caulk window and door frames as needed.

2.7.5.2.2 Maintain storm windows annually.

2.7.5.2.3 Maintain building insulation where damaged or missing.

2.7.5.2.4 Maintain weather-strips on doors and windows as needed.
2.7.5.3 Electrical

2.7.5.3.1 Turn out lights when they are left on.
2.7.5.3.2 During routine maintenance visits replace lamps with energy conserving type.
2.7.5.3.3 During routine maintenance visits replace ballasts with energy conserving types.
2.7.5.3.4 Maintain photocells as needed.
2.7.5.3.5 Where feasible, replace incandescent lighting with fluorescent lighting.
2.7.5.3.6 Lubricate motors on a regular basis.
2.7.5.3.7 Repair or replace bad bearings and motors.
2.7.5.3.8 Replace failed motors with high efficiency type.
2.7.5.3.9 Maintain VSDs.
2.7.5.3.10 Notify Energy Management of potential new VSD applications.

2.7.5.4 HVAC - General:

2.7.5.4.1 Repair HVAC leaks.
2.7.5.4.2 Clean heat transfer surfaces and fan blades.
2.7.5.4.3 Repair or replace bad bearings, gear drives and pumps.
2.7.5.4.4 Replace worn belts.
2.7.5.4.5 Maintain pipe and duct insulation where damaged or missing.
2.7.5.4.6 Change filters at proper intervals.
2.7.5.4.7 Maintain HVAC field controls (i.e. sensors, actuators, valves, and dampers).
2.7.5.4.8 Maintain seals around window air conditioners.
2.7.5.4.9 Maintain Time clocks and check for proper operation (pins in and correct time).
2.7.5.4.10 Maintain EMS system for proper operation.

2.7.5.5 HVAC - Chiller and Cooling Tower:

2.7.5.5.1 Maintain condenser water and chilled water chemistry to minimize fouling.
2.7.5.5.2 Clean condenser tubes biannually.
2.7.5.5.3 Check for refrigerant leaks and repair. Keep records of all leaks and repairs.
2.7.5.4 Maintain blowdown and chemical feed for cooling tower.

2.7.5.5 Maintain proper operation of controls.

2.7.5.6 Maintain daily log on operations.

2.7.5.6 Steam, Condensate and Hot Water:

2.7.5.6.1 Repair steam and condensate leaks.

2.7.5.6.2 Maintain steam trap inspection program and repair/replace when defective.

2.7.5.6.3 Replace or repair steam and condensate piping insulation where damaged or missing.

2.7.5.6.4 Replace or repair hot water tanks and heat exchanger insulation where damaged or missing.

2.7.5.6.5 Replace failed manual radiator valves with thermostatic valves.

2.7.5.6.6 Maintain condensate receivers and pumps.

2.7.5.6.7 Repair or replace condensate check valves where they have failed.

2.7.5.6.8 Check efficiency of gas boilers and perform annual tune-ups.

2.7.5.6.9 Check for leaking relief valves and replace where necessary.

2.7.5.6.10 Check for leaking CW and heating control valves.

2.7.5.7 Water:

2.7.5.7.1 Minimize hot water storage and distribution and distribution temperature.

2.7.5.7.2 Minimize water use by using low flow lavatory fixtures, shower heads and toilets.

2.7.5.7.3 Repair water leaks.
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CHAPTER 11 – APPENDICES

APPENDIX 3 – MASTERSPEC
### Appendix 3 MASTERSPEC

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<p>| 3.1.1 | Division 1 – General Requirements |
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| 3.1.3 | Division 3 – Concrete              |
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| 3.1.14| Division 14 – Conveying Systems    |
| 3.1.15| Division 15 – Mechanical           |
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January 2004

* = Sections updated or added since last issue
Basic* = Available in Short Form Version
Con* = Interiors Supplement to A/S/C Basic Version

**M A S T E R S P E C C O N S O L I D A T E D T A B L E O F C O N T E N T S - D E C E M B E R 1 9 9 9 - P a g e 5**
## Division 2 - Site Construction

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<tr>
<td>02510</td>
<td>Water Distribution</td>
<td>Basic*</td>
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<td>Drilled and driven wells and well pumps.</td>
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<td>02525</td>
<td>Water Supply Wells</td>
<td>Sup</td>
<td>Sup</td>
<td>Sup</td>
<td>9/1/99</td>
<td>Sanitary sewerage and underground structures.</td>
</tr>
<tr>
<td>02530</td>
<td>Sanitary Sewerage</td>
<td>Basic*</td>
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<td>9/1/99</td>
<td>Pump, compressor, tank, and controls.</td>
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<td>02532</td>
<td>Packaged Pumping Stations</td>
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<td>Chemical waste, neutralizing tanks, and containment conduit.</td>
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<td>Septic Tank Systems</td>
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<td>Tank, distribution box, and drainage pipe.</td>
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<td>Pipe, fittings, and specialties for aboveground and belowground.</td>
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<td>Geothermal Energy Recovery Piping</td>
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<td>Horizontal and vertical closed-loop piping.</td>
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<td>Natural gas service from utility to building and site distribution.</td>
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<td>Above- and belowground storage tanks &amp; piping.</td>
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<td>9/1/96</td>
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<td>02582</td>
<td>Lighting Poles and Standards</td>
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<td>Basic*</td>
<td>Basic*</td>
<td>6/1/99</td>
<td>Street, roadway, and parking light standards.</td>
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<td>02584</td>
<td>Underground Ducts and Utility Structures</td>
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<td>Manholes, handholes, and underground ducts.</td>
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<td>02620</td>
<td>Subdrainage</td>
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<td>Basic*</td>
<td>3/1/99</td>
<td>Drainage for underfloor, foundations, retaining walls, and landscaped areas.</td>
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<td>02630</td>
<td>Storm Drainage</td>
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<td>Basic*</td>
<td>9/1/97</td>
<td>Gravity and forced storm piping and underground structures.</td>
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<td>02666</td>
<td>Pond and Reservoir Liners</td>
<td>Basic*</td>
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<td>5/1/97</td>
<td>Temporary, long-term storage.</td>
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<td>02741</td>
<td>Hot-Mix Asphalt Paving</td>
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<td>11/1/99</td>
<td>Paving, overlays, and surface treatments.</td>
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<td>General applications.</td>
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<td>02764</td>
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<td>Sealants for concrete and asphalt pavement joints.</td>
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<td>Surface-imprinted, stamped-finish concrete pavement.</td>
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<td>Unit Pavers</td>
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<td>Playground Surface Systems</td>
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<td>Impact-attenuating, protective surface systems designed for use under and around public playground equipment.</td>
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<td>02813</td>
<td>Lawn Sprinkler Piping</td>
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<td>Basic*</td>
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<td>12/1/96</td>
<td>Heads, pipes, and controls.</td>
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<td>02821</td>
<td>Chain-Link Fences and Gates</td>
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<td>Standard chain-link fencing systems.</td>
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<td>Segmental Retaining Walls</td>
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<td>Dry-laid concrete masonry unit walls.</td>
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<tr>
<td>02870</td>
<td>Site and Street Furnishings</td>
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<td>Basic*</td>
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<td>Benches, ganged seats, bicycle racks, and receptacles for outdoor locations.</td>
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<td>02881</td>
<td>Playground Equipment and Structures</td>
<td>Sup</td>
<td>Basic*</td>
<td>Basic*</td>
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<td>Public playground equipment.</td>
</tr>
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APP-3-6
January 2004

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**Notes:**
- Basic* = Available in Short Form Version
- Basic* = Interiors Supplement to A/S/C Basic Version
- Basic = Instructing Owner's personnel.
DIVISION 3 - CONCRETE

03300 CAST-IN-PLACE CONCRETE Basic* Basic* Basic* Basic* 11/1/97 General applications.
03301 CAST-IN-PLACE CONCRETE (LIMITED APPLICATIONS) Basic Basic Basic 11/1/97 Limited applications for smaller projects.
03331 CAST-IN-PLACE ARCHITECTURAL CONCRETE SHOTCRETE Sup Sup Basic* 5/1/99 Pneumatically projected mortar and concrete.
03410 PLANT-PRECAST STRUCTURAL CONCRETE Basic* Basic* 8/1/98 Conventional precast units.
03450 PLANT-PRECAST ARCHITECTURAL CONCRETE Basic* Basic* Basic* 8/1/98 Exposed surface units.
03470 TILT-UP PRECAST CONCRETE Basic* Basic* 2/1/98 Wall panels.
03490 GLASS-FIBER-REINFORCED PRECAST CONCRETE Basic* Basic* 5/1/98 Lightweight facing members.
03511 CEMENTITIOUS WOOD-FIBER DECK Sup Sup 5/1/99 Tiles, planks, and composite units; subpurlins.
03520 LIGHTWEIGHT CONCRETE ROOF INSULATION Basic* Basic* 8/1/98 Mineral-aggregate and foam types.
03532 CONCRETE FLOOR TABBING Basic* Basic* 2/1/98 Applied over base slabs.
03542 CEMENT-BASED UNDERLAYMENT Basic* Con 8/1/97 Self-leveling, hydraulic-cement underlayment.
03930 CONCRETE REHABILITATION Sup Sup 2/1/99 Includes concrete patching, repair, reinforcing, sealing, and crack injection.

DIVISION 4 - MASONRY

04720 CAST STONE Basic* 11/1/97 Architectural features, facing, trim, and site accessories.
04810 UNIT MASONRY ASSEMBLIES Basic* Basic* Con Basic* 2/1/98 General applications, walls, partitions.
04815 GLASS UNIT MASONRY ASSEMBLIES Basic* Basic* Con 8/1/98 Glass block.
04851 DIMENSION STONE CLADDING Basic* Basic* 8/1/98 Exterior stone panels.
04860 STONE VENEER ASSEMBLIES Basic* Basic* 11/1/99 Stone veneer laid in mortar.
04901 CLAY MASONRY RESTORATION AND CLEANING Basic* Basic* 8/1/96 Historic and nonhistoric applications.
04902 STONE RESTORATION AND CLEANING Basic* Basic* 8/1/96 Historic and nonhistoric applications.

DIVISION 5 - METALS

05120 STRUCTURAL STEEL Basic* Basic* 11/1/94 Framing systems.
05210 STEEL JOISTS Basic* Basic* 8/1/98 Standard SJI units.
05310 STEEL DECK Basic* Basic* 5/1/98 Roof, floor, composite types.
05400 COLD-FORMED METAL FRAMING Basic* Basic* 5/1/98 Load-bearing and curtain-wall studs; floor, ceiling, and roof joists; rafters and roof trusses; gypsum sheathing; and air-infiltration barriers.
05600 METAL FABRICATIONS Basic* Basic* Basic* Basic* Con Basic* 5/1/97 Iron and steel items (not sheet metal).
05511 METAL STAIRS Basic* Basic* Con 5/1/97 Steel; with pan, plate, and gratings treads.
05521 PIPE AND TUBE RAILINGS Basic* Basic* Con Basic* 5/1/97 Railings fabricated from aluminum, stainless-steel, and steel pipe and tubing.
05530 GRATINGS Basic* Basic* Con 5/1/98 Metal-bar, expanded-metal, and metal-plank types.
05580 FORMED-METAL FABRICATIONS Basic* Basic* Con 5/1/97 Custom sheet metal fabrications; no flashing.
05700 ORNAMENTAL METAL Basic* Basic* Con 5/1/97 Custom fabrications from nonferrous and ferrous metals.
05715 FABRICATED SPIRAL STAIRS Sup Sup Con* 8/1/98 Standard units.
05720 ORNAMENTAL HANDRAILS AND RAILINGS Basic* Basic* Con 5/1/97 Ornamental metal and glass raking systems fabricated from stock metal shapes.
05811 ARCHITECTURAL JOINT SYSTEMS Basic* Basic* 2/1/99 For exterior and interior applications.

DIVISION 6 - WOOD AND PLASTICS

02920 LAWS AND GRASSES Basic* Basic* Basic* 8/1/99 Seeded, sodded, plugged, and sprigged lawns.
02930 EXTERIOR PLANTS Basic* Basic* Basic* 8/1/99 Trees, shrubs, ground cover, and plants.
### DIVISION 7 - THERMAL AND MOISTURE PROTECTION

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<th>Division</th>
<th>Title</th>
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<td>ROUGH CARPENTRY</td>
<td>Basic*</td>
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<td>07150</td>
<td>WOOD DECKING</td>
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<td>HOT FLUID-APPLIED WATERPROOFING</td>
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<td>07180</td>
<td>TRAFFIC COATINGS</td>
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<td>07210</td>
<td>BUILDING INSULATION</td>
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<td>07315</td>
<td>SLATE SHINGLES</td>
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<td>07317</td>
<td>WOOD SHINGLES AND SHAKES</td>
<td>Basic*</td>
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<td>07320</td>
<td>ROOF TILES</td>
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<td>MANUFACTURED WALL PANELS</td>
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<td>SIDING</td>
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<td>BUILT-UP ASPHALT ROOFING</td>
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**January 2004**

* = Sections updated or added since last issue
Basic* = Available in Short Form Version
Con* = Interiors Supplement to A/S/C Basic Version
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<td>COATED FOAMED ROOFING</td>
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<td>5/1/99 Sprayed foam roofing, elastomeric coated.</td>
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<td>07610</td>
<td>SHEET METAL ROOFING</td>
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<td>07620</td>
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<td>MANUFACTURED ROOF SPECIALTIES</td>
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<td>07716</td>
<td>ROOF EXPANSION ASSEMBLIES</td>
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<td>07720</td>
<td>ROOF ACCESSORIES</td>
<td>Basic*</td>
<td>8/1/97 Vents, hatches, roof curbs, and roof walkways.</td>
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<td>07810</td>
<td>PLASTIC UNIT SKYLIGHTS</td>
<td>Basic*</td>
<td>5/1/92 Single- and double-dome acrylic units.</td>
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<td>07811</td>
<td>SPRAYED FIRE-RESISTIVE MATERIALS</td>
<td>Basic*</td>
<td>8/1/96 Concealed and exposed cementitious, sprayed-fiber, Mg</td>
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<td>oxchloride cement, and intumescent mastic.</td>
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<td>07821</td>
<td>BOARD FIRE PROTECTION</td>
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<td>2/1/98 Through-penetration firestop systems.</td>
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<td>07841</td>
<td>THROUGH-PENETRATION FIRESTOP SYSTEMS</td>
<td>Basic*</td>
<td>8/1/99 For floor-to-floor, wall-to-wall, floor-to-wall, head-of-wall,</td>
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<td></td>
<td></td>
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<td>and perimeter-floor-to-curtain wall joints.</td>
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<tr>
<td>07842</td>
<td>FIRE-RESISTIVE JOINT SYSTEMS</td>
<td>Basic*</td>
<td>2/1/97 Elastomeric, nonelastomeric, and preformed sealants.</td>
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**DIVISION 8 - DOORS AND WINDOWS**

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<td>STEEL DOORS AND FRAMES</td>
<td>Basic*</td>
<td>2/1/99 Standard units complying with ANSI A250.8.</td>
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<td>08114</td>
<td>CUSTOM STEEL DOORS AND FRAMES</td>
<td>Basic*</td>
<td>5/1/98 Units of nonstandard shapes and sizes.</td>
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<td>08125</td>
<td>INTERIOR ALUMINUM FRAMES</td>
<td>Sup Con*</td>
<td>2/1/98 For doors, glass sidelights, borrowed lights, and fixed</td>
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<tr>
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<td>windows in interior partitions.</td>
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<tr>
<td>08161</td>
<td>SLIDING METAL FIRE DOORS</td>
<td>Sup Con*</td>
<td>8/1/99 Composite and hollow-metal types.</td>
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<td>08163</td>
<td>SLIDING ALUMINUM-FRAMED GLASS DOORS</td>
<td>Basic*</td>
<td>8/1/97 For exterior locations.</td>
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<td>08211</td>
<td>FLUSH WOOD DOORS</td>
<td>Basic*</td>
<td>11/1/96 Solute and rail units, stock and custom.</td>
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<tr>
<td>08212</td>
<td>STILE AND RAIL WOOD DOORS</td>
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<td>08263</td>
<td>SLIDING WOOD-FRAMED GLASS DOORS</td>
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<td>08311</td>
<td>ACCESS DOORS AND FRAMES</td>
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<td>INSULATING SECURITY DOORS</td>
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<td>5/1/96 Fire-rated file room and vault doors.</td>
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<td>OVERHEAD COILING DOORS</td>
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<td>8/1/96 Steel and aluminum curtains.</td>
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<td>OVERHEAD COILING GRILLES</td>
<td>Basic*</td>
<td>8/1/96 Open-mesh curtains.</td>
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<td>IUC/ICU ENTRANCE DOORS</td>
<td>Sup Con*</td>
<td>8/1/97 Combination swing/slide manual type.</td>
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<td>08346</td>
<td>SOUND CONTROL DOORS</td>
<td>Sup Con*</td>
<td>8/1/97 Swinging door and frame systems with STC ratings between</td>
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<td>08351</td>
<td>FOLDING DOORS</td>
<td>Basic*</td>
<td>8/1/93 Wood and fabric types.</td>
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<td>8/1/96 Steel, aluminum, and plastic panels.</td>
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<td>ALUMINUM ENTRANCES AND STOREFRONTS</td>
<td>Basic*</td>
<td>8/1/95 Standard systems, hardware.</td>
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<td>08450</td>
<td>ALL-GLASS ENTRANCES</td>
<td>Basic*</td>
<td>8/1/95 Tempered glass without frames.</td>
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<td>8/1/97 Swinging for one-way, two-way, and double-egress traffic.</td>
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<td>REVOLVING ENTRANCE DOORS</td>
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<td>11/1/97 Standard entrance units.</td>
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<td>STEEL WINDOWS</td>
<td>Basic*</td>
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- RESISTANT BRICK FLOORING
- APPLIED ATHLETIC FLOORING

**RESILIENT ATHLETIC FLOORING**

- Polyurethane flooring for athletic activity areas.

**FLUID SUSPENDED DECORATIVE GRIDS**

- Strip, decorative metal systems.

**ACOUSTICAL SNAP-IN METAL PAN CEILINGS**

- Strip, decorative metal systems.

**ACOUSTICAL PANEL CEILINGS**

- Strip, decorative metal systems.

**EPOXY TERRAZZO**

- Strip, decorative metal systems.

**CEMENTITIOUS TERRAZZO**

- Strip, decorative metal systems.

**CERAMIC TILE**

- Strip, decorative metal systems.

**DIMENSION STONE TILE**

- Strip, decorative metal systems.

**TERRAZZO**

- Strip, decorative metal systems.

**GLASS-REINFORCED GYPSUM FABRICATIONS**

- Strip, decorative metal systems.

**GYPSPUM BOARD SHAFT-WALL ASSEMBLIES**

- Strip, decorative metal systems.

**GYPSPUM BOARD ASSEMBLIES**

- Strip, decorative metal systems.

**GYPSPUM VENEER PLASTER**

- Strip, decorative metal systems.

**GYPSPUM PLASTER**

- Strip, decorative metal systems.

**SECURITY GLAZING**

- Strip, decorative metal systems.

**GLAZING**

- Strip, decorative metal systems.

**POWER DOOR OPERATORS**

- Strip, decorative metal systems.

**PLASTIC GLAZING**

- Strip, decorative metal systems.

**GLAZED ALUMINUM CURTAIN WALLS**

- Strip, decorative metal systems.

**STRUCTURAL-SEALANT-GLAZED CURTAIN WALLS**

- Strip, decorative metal systems.

**SLOPED GLAZING SYSTEMS**

- Strip, decorative metal systems.

**DOOR HARDWARE**

- Strip, decorative metal systems.

**DOOR HARDWARE (SCHEDULED BY NAMING PRODUCTS)**

- Strip, decorative metal systems.

**DOOR HARDWARE (SCHEDULED BY DESCRIBING PRODUCTS)**

- Strip, decorative metal systems.

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10 - SPECIALTIES

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10605 WIRE MESH PARTITIONS  Basic*  Con  2/1/95 Freestanding and overhead braced.
10615 DEMOUNTABLE PARTITIONS  Sup  Con*  5/1/98 Evaluations only - for site-assembled demountable partitions.
10616 SITE-ASSEMBLED DEMOUNTABLE PARTITIONS  Sup  Con*  5/1/98 Demountable partition systems consisting of gypsum board or metal-faced gypsum board panels supported by concealed framing.
10620 DEMOUNTABLE UNITIZED-PANEL PARTITIONS  Sup  Con*  5/1/98 Demountable partition systems consisting of factory-assembled units.
10651 OPERABLE PANEL PARTITIONS  Basic*  Con  2/1/98 Acoustically rated, manually and electrically operated, flat-panel partitions.
10653 FIRE-RATED OPERABLE PANEL PARTITIONS  Basic*  Con  2/1/98 Acoustically rated, manually operated, flat-panel partitions, fire rated 1 or 1-1/2 hours.
10655 ACCORDION FOLDING PARTITIONS  Basic*  Con  2/1/98 Acoustically rated, manually and electrically operated, accordion folding partitions.
10671 METAL STORAGE SHELVING  Sup  Con*  8/1/96 Normal density office/medical/retail storage.
10680 MOBILE STORAGE UNITS  FF&E  4/1/96 Manually and electronically operated.
10750 TELEPHONE SPECIALTIES  Basic*  Con  8/1/99 Telephone enclosures and directory storage units.
10801 TOILET AND BATH ACCESSORIES  Basic*  Con  2/1/97 Standard commercial and institutional units.

ON 11 - EQUIPMENT

11054 LIBRARY STACK SYSTEMS  FF&E  1/1/96 Shelving, including multi-tier.
11062 FOLDING AND PORTABLE STAGES  Basic*  Con  11/1/97 Portable stages, risers, acoustic shells.
11063 STAGE CURTAINS  Basic*  Con  11/1/97 Includes fabrics and tracks.
11132 PROJECTION SCREENS  Basic*  Con  2/1/96 Electric, manual, standard units.
11150 PARKING CONTROL EQUIPMENT  Basic*  Con  11/1/96 Basic components and cashier's booths.
11160 LOADING DOCK EQUIPMENT  Basic*  Con  11/1/96 Dock bumpers, levelers, seals, lifts, truck restraints, seals, shelters, and transparent strip door curtains.
11172 WASTE COMPACTORS  Basic*  Con  5/1/98 Solid, dry- and wet-waste compactor units.
11400 FOOD SERVICE EQUIPMENT  Basic*  Con  8/1/95 Commercial food service equipment.
11451 RESIDENTIAL APPLIANCES  Basic*  Con  2/1/97 Kitchen and laundry appliances.
11460 UNIT KITCHENS  Basic*  Con  8/1/98 Standard metal and plastic-laminate types.
11490 GYMNASIUM EQUIPMENT  Basic*  Con  5/1/99 Indoor badminton, basketball, volleyball, and wall-mounted exercise equipment.
11610 LABORATORY FUME HOODS  Sup  Con*  11/1/95 Countertop units for general laboratories.
11695 MAILROOM EQUIPMENT  FF&E  1/1/93 Equipment and furniture.

ON 12 - FURNISHINGS

12050 FABRICS  FF&E  8/1/98 Textile and leather evaluations for several applications.
12100 ART  FF&E  4/1/95 Evaluations only.
12311 METAL FILE CABINETS  FF&E  7/1/96 Vertical and lateral units.
12320 RESTAURANT AND CAFETERIA CASEWORK  Con*  10/1/88 Cashier counter wait stations, and casework.
12347 METAL LABORATORY CASEWORK  Sup  Con*  11/1/95 Modular type with enameled finish.
12348 WOOD LABORATORY CASEWORK  Sup  Con*  11/1/95 Modular type with plastic-laminate and clear finish.
12353 DISPLAY CASEWORK  FF&E  11/1/96 Retail displays and cash registers.
12355 INSTITUTIONAL CASEWORK  Sup  Con*  11/1/99 Manufactured wood- and plastic-faced units and countertops.
12356 KITCHEN CASEWORK  Basic*  Con  8/1/97 Manufactured cabinets and countertops.
12359 METAL MEDICAL CASEWORK  Sup  Con*  5/1/96 Stainless- and enameled-steel units including countertops, sinks, and accessories.
12361 MAILROOM CASEWORK  FF&E  7/1/96 Sorting and wrapping consoles.
12483 CUSTOM RUGS  FF&E  8/1/88 Project-specific, custom-designed rugs.
12494 FLOOR MATS AND FRAMES  Con  9/1/99 Recessed and surface-applied flexible floor mats and frames.
12485 FOOT GRILLES  Basic*  Con  5/1/99 Metal, plastic, with various tread surfaces; recessed; metal frames.
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**ON 13 - SPECIAL CONSTRUCTION**

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<td>13915</td>
<td>Fire-Suppression Piping</td>
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<td>Fire Pumps</td>
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APP-3-13
January 2004

* = Sections updated or added since last issue  Basic* = Available in Short Form Version  Con* = Interiors Supplement to A/S/C Basic Version
## ON 14 - CONVEYING SYSTEMS

<table>
<thead>
<tr>
<th>Code</th>
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<tr>
<td>1400</td>
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<tr>
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<td>5/1/99</td>
<td>Standard preengineered, heavy-duty, and exterior units.</td>
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<td>14320</td>
<td>MOVING WALKS</td>
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<td>Horizontal or inclined pallet- or belt-type units.</td>
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<td>14420</td>
<td>WHEELCHAIR LIFTS</td>
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<td>8/1/95</td>
<td>Vertical and inclined types; and chairlifts.</td>
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<tr>
<td>14512</td>
<td>TRACK VEHICLE SYSTEMS</td>
<td>Sup</td>
<td>Con*</td>
<td>8/1/93</td>
<td>Self-propelled containers on electrified tracks.</td>
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<tr>
<td>14559</td>
<td>SELECTIVE VERTICAL CONVEYORS</td>
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<td>Con*</td>
<td>8/1/93</td>
<td>Detachable containers transported in a shaft.</td>
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<tr>
<td>14560</td>
<td>CHUTES</td>
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<td>Vertical free-fall types.</td>
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## ON 15 - MECHANICAL

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<tr>
<td>15050</td>
<td>BASIC MECHANICAL MATERIALS AND METHODS</td>
<td>Basic*</td>
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<td>12/1/99</td>
<td>Mechanical materials and methods common to multiple mechanical systems.</td>
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<tr>
<td>15055</td>
<td>MOTORS</td>
<td>Basic*</td>
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<td>For pipe and equipment.</td>
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<tr>
<td>15060</td>
<td>HANGERS AND SUPPORTS</td>
<td>Basic*</td>
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<td>6/1/99</td>
<td>Vibration isolation devices; seismic restraints.</td>
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<tr>
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<td>MECHANICAL VIBRATION AND SEISMIC CONTROLS</td>
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<td>Labels, tags, nameplates, and valve tags.</td>
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<td>15075</td>
<td>MECHANICAL IDENTIFICATION</td>
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<td>Preformed pipe insulation, jackets, and specialties.</td>
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<td>PIPE EXPANSION FITTINGS AND LOOPS</td>
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<td>Temperature, pressure, and flow.</td>
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<td>METERS AND GAGES</td>
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<td>Potable-water distribution within the building, hot and cold supply (BOCA definition).</td>
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<td>SANITARY WASTE AND VENT PIPING</td>
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<td>Soil, waste, and vent piping within the building.</td>
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<td>LP and HP piping and specialties.</td>
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<td>Piping, specialties, and refrigerant.</td>
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<td>Steam and hot-water heat-exchanger types; instantaneous and with storage.</td>
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<td>6/1/96</td>
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<td>Packaged condensing boilers for small applications.</td>
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<td>6/1/96</td>
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<td>6/1/98</td>
<td>Condensate and vacuum pumps and receivers.</td>
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<td>3/1/99</td>
<td>Spray, packed column, and package tray.</td>
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<td>FURNACES</td>
<td>Basic*</td>
<td>9/1/99</td>
<td>Gas-, electric- and oil-fired furnaces.</td>
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<td>15540</td>
<td>FUEL-FIRED HEATERS</td>
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<td>9/1/99</td>
<td>Evaluations for all kinds of fuel-fired heaters.</td>
<td></td>
</tr>
<tr>
<td>15541</td>
<td>FUEL-FIRED DUCT HEATERS</td>
<td>Basic*</td>
<td>9/1/99</td>
<td>Gas- and oil-fired units.</td>
<td></td>
</tr>
<tr>
<td>15542</td>
<td>FUEL-FIRED RADIANT HEATERS</td>
<td>Basic*</td>
<td>9/1/99</td>
<td>Natural and LP units.</td>
<td></td>
</tr>
<tr>
<td>15543</td>
<td>FUEL-FIRED UNIT HEATERS</td>
<td>Basic*</td>
<td>9/1/99</td>
<td>Gas- and oil-fired units.</td>
<td></td>
</tr>
<tr>
<td>15550</td>
<td>BREECHINGS, CHIMNEYS, AND STACKS</td>
<td>Basic*</td>
<td>9/1/97</td>
<td>Double-wall and refractory-lined breechings and stacks; fabricated breechings.</td>
<td></td>
</tr>
<tr>
<td>15560</td>
<td>FUEL-FIRED H&amp;V UNITS</td>
<td>Basic*</td>
<td>9/1/97</td>
<td>Evaluations only for all kinds of fuel-fired H&amp;V units.</td>
<td></td>
</tr>
<tr>
<td>15561</td>
<td>DIRECT-FIRED, MAKEUP AIR UNITS</td>
<td>Basic*</td>
<td>9/1/97</td>
<td>Indoor and outdoor units without heat exchangers.</td>
<td></td>
</tr>
<tr>
<td>15562</td>
<td>INDIRECT-FIRED, PACKAGED H&amp;V UNITS</td>
<td>Basic*</td>
<td>9/1/97</td>
<td>Factory-assembled indoor and outdoor units.</td>
<td></td>
</tr>
<tr>
<td>15563</td>
<td>DESTRAFICATION H&amp;V UNITS</td>
<td>Basic*</td>
<td>9/1/97</td>
<td>Indoor floor-mounting units.</td>
<td></td>
</tr>
<tr>
<td>15621</td>
<td>INDIRECT-FIRED ABSORPTION WATER CHILLERS</td>
<td>Sup</td>
<td>6/1/96</td>
<td>Steam and hot-water generated; 1 and 2 stage.</td>
<td></td>
</tr>
<tr>
<td>15622</td>
<td>DIRECT-FIRED ABSORPTION CHILLERS</td>
<td>Sup</td>
<td>6/1/96</td>
<td>Natural gas, LP, and oil fired; water cooled; two stage.</td>
<td></td>
</tr>
<tr>
<td>15625</td>
<td>CENTRIFUGAL WATER CHILLERS</td>
<td>Basic*</td>
<td>12/1/96</td>
<td>Hermetic and open, direct and gear drives.</td>
<td></td>
</tr>
<tr>
<td>15628</td>
<td>RECIPROCATING WATER CHILLERS</td>
<td>Basic*</td>
<td>12/1/96</td>
<td>Water and air cooled.</td>
<td></td>
</tr>
<tr>
<td>15635</td>
<td>REFRIGERANT MONITORING AND SAFETY EQUIPMENT</td>
<td>Basic*</td>
<td>6/1/99</td>
<td>Monitors, alarms, breathing apparatus, and ventilation equipment interlocks.</td>
<td></td>
</tr>
<tr>
<td>15640</td>
<td>PACKAGED COOLING TOWERS</td>
<td>Basic*</td>
<td>12/1/96</td>
<td>Induced draft &amp; forced draft; counterflow and cross flow.</td>
<td></td>
</tr>
<tr>
<td>15661</td>
<td>FLUID COOLERS</td>
<td>Basic*</td>
<td>12/1/96</td>
<td>Blow through and counterflow.</td>
<td></td>
</tr>
<tr>
<td>15663</td>
<td>EVAPORATIVE CONDENSERS</td>
<td>Basic*</td>
<td>12/1/96</td>
<td>Blow through and counterflow.</td>
<td></td>
</tr>
<tr>
<td>15671</td>
<td>CONDENSING UNITS</td>
<td>Basic*</td>
<td>3/1/96</td>
<td>Air and water cooled.</td>
<td></td>
</tr>
<tr>
<td>15672</td>
<td>AIR-COOLED CONDENSERS</td>
<td>Basic*</td>
<td>3/1/96</td>
<td>Remote forced-air, condenser and fan units.</td>
<td></td>
</tr>
<tr>
<td>15684</td>
<td>ROTARY-SCREW CHILLERS</td>
<td>Sup</td>
<td>6/1/95</td>
<td>Air- and water-cooled helical-screw chillers.</td>
<td></td>
</tr>
<tr>
<td>15710</td>
<td>HEAT EXCHANGERS</td>
<td>Basic*</td>
<td>9/1/97</td>
<td>Steam to water; water to water.</td>
<td></td>
</tr>
<tr>
<td>15725</td>
<td>MODULAR INDOOR AIR-HANDLING UNITS</td>
<td>Basic*</td>
<td>9/1/99</td>
<td>Units consisting of fans, coils, dampers, filters, control devices, and accessories.</td>
<td></td>
</tr>
</tbody>
</table>
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- **15732** ROOFTOP AIR CONDITIONERS  
  - Basic*  
  - 12/1/99 Packaged, rooftop HVAC.

- **15736** SELF-CONTAINED AIR-CONDITIONING UNITS (15 TONS AND SMALLER)  
  - Basic*  
  - 12/1/97 Packaged cooling, heating, filters, and controls; suitable for exposed installations.

- **15737** SELF-CONTAINED AIR-CONDITIONING UNITS (LARGER THAN 15 TONS)  
  - Basic*  
  - 12/1/97 Packaged cooling, heating, filters, and controls; cabinet suitable for exposed installations.

- **15738** SPLIT-SYSTEM AIR-CONDITIONING UNITS  
  - Basic*  
  - 12/1/97 Air-distribution equipment separate from refrigeration equipment; cabinet suitable for exposed installations.

- **15745** WATER-SOURCE HEAT PUMPS  
  - Basic*  
  - 6/1/96 For CII-type buildings.

- **15752** HUMIDIFIERS  
  - Sup  
  - 3/1/98 Steam and evaporative types.

- **15761** AIR COILS  
  - Basic*  
  - 12/1/97 Water, steam, and electric heat-transfer coils.

- **15762** ELECTRIC RADIATORS  
  - Basic*  
  - 12/1/99 Electric baseboard, finned-tube radiation, convectors, and radiant panels.

- **15763** FAN-COIL UNITS  
  - Basic*  
  - 12/1/98 Hot water, chilled water, and steam.

- **15764** RADIATORS  
  - Basic*  
  - 12/1/98 Hot water and steam.

- **15766** CABINET UNIT HEATERS  
  - Basic*  
  - 12/1/98 Hot water, steam, and electric.

- **15767** PROPELLER UNIT HEATERS  
  - Basic*  
  - 12/1/98 Hot water, steam, and electric.

- **15768** UNIT VENTILATORS  
  - Basic*  
  - 12/1/98 Hot water, steam, or electric heating; chilled or DX cooling.

- **15769** RADIANT HEATING PANELS  
  - Basic*  
  - 12/1/98 Electric and hot water.

- **15772** RADIANT HEATING PIPING  
  - Basic*  
  - 3/1/99 Embedded pipe and fittings.

- **15775** ELECTRIC HEATING CABLES  
  - Basic*  
  - 3/1/98 Ceiling and floor cables and heat tracing.

- **15783** COMPUTER-ROOM AIR-CONDITIONING UNITS  
  - Basic*  
  - 12/1/95 Vertical and horizontal units.

- **15784** PACKAGED TERMINAL AIR-CONDITIONING UNITS  
  - Basic*  
  - 12/1/95 Freestanding or through-the-wall units.

- **15785** AIR-TO-AIR ENERGY RECOVERY UNITS  
  - Sup  
  - 9/1/99 Heat exchangers and packaged units.

- **15812** FIBROUS-GLASS DUCTS  
  - Basic*  
  - 9/1/96 Duct board and rigid round ducts, hangers, and supports.

- **15815** METAL DUCTS  
  - Basic*  
  - 9/1/96 Rectangular and round, including hangers and supports.

- **15816** HVAC CASINGS  
  - Sup  
  - 9/1/96 Factory and field fabricated.

- **15820** DUCT ACCESSORIES  
  - Basic*  
  - 9/1/96 Volume dampers, fire and smoke dampers, vanes, duct silencers, and hardware.

- **15830** FANS  
  - Basic*  
  - 3/1/99 Evaluations only; centrifugal fans, axial fans, and power ventilators.

- **15834** AIR CURTAINS  
  - Basic*  
  - 3/1/98 Fans over entrances with and without heating.

- **15836** AXIAL FANS  
  - Basic*  
  - 3/1/99 Propeller and vaneaxial fans.

- **15837** CENTRIFUGAL FANS  
  - Basic*  
  - 3/1/99 BI & FC indoor type; tubular & in-line units.

- **15838** POWER VENTILATORS  
  - Basic*  
  - 3/1/99 Roof, wall, and ceiling-mounted ventilators.

- **15845** AIR TERMINALS  
  - Basic*  
  - 6/1/96 Constant- and variable-volume units.

- **15855** DIFFUSERS, REGISTERS, AND GRILLES  
  - Basic*  
  - 3/1/96 Diffusers, registers, and grilles.

- **15861** AIR FILTERS  
  - Basic*  
  - 12/1/96 Disposable, cleanable, roll, and HEPA.

- **15870** COMMERCIAL KITCHEN HOODS  
  - Basic*  
  - 6/1/99 Type I and Type II, Standard and Listed hoods.

- **15900** HVAC INSTRUMENTATION AND CONTROLS  
  - Basic*  
  - 6/1/98 Electric, electronic, pneumatic, and DDC equipment and devices.

- **15940** SEQUENCE OF OPERATION  
  - Basic*  
  - 6/1/98 Control sequences for HVAC systems.

- **15990** TESTING, ADJUSTING, AND BALANCING  
  - Basic*  
  - 12/1/95 Air and hydronic systems.

---

**SECTION 16 - ELECTRICAL**

- **16050** BASIC ELECTRICAL MATERIALS AND METHODS  
  - Basic*  
  - 12/1/97 Materials and methods common to multiple electrical systems.

- **16055** OVERCURRENT PROTECTIVE DEVICE COORDINATION  
  - Sup  
  - 12/1/99 Fault-current and protective device coordination studies.

- **16060** GROUNDING AND BONDING  
  - Basic*  
  - 6/1/98 Systems and equipment.

- **16071** SEISMIC CONTROLS FOR ELECTRICAL WORK  
  - Basic*  
  - 3/1/98 Anchorage, fastening, and bracing devices.

- **16075** ELECTRICAL IDENTIFICATION  
  - Sup  
  - 12/1/97 Markers, tags, plaques, and diagrams.

- **16080** ELECTRICAL TESTING  
  - Basic*  
  - 9/1/99 General requirements for electrical testing and inspecting.

- **16120** CONDUCTORS AND CABLES  
  - Basic*  
  - 12/1/99 Electrical power distrib. - 600 V and less.

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* = Sections updated or added since last issue  
Basic* = Available in Short Form Version  
Con* = Interiors Supplement to A/S/C Basic Version  
12/1/99 The American Institute of Architects

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Basic and Supplemental Versions

STRUCTURAL/CIVIL LIBRARY  
Basic and Supplemental Versions

MECHANICAL/ELECTRICAL LIBRARY  
Basic and Supplemental Versions

INTERIORS LIBRARY  
Basic and Supplemental Versions

LANDSCAPE ARCHITECTURE LIBRARY  
Basic Version

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| 16121 | CONTROL/SIGNAL TRANSMISSION MEDIA | Basic* | 6/1/96 | Coaxial and twisted pair. |
| 16122 | UNDERCARPET CABLES | Basic* | 6/1/96 | For building wiring. |
| 16124 | MEDIUM-VOLTAGE CABLES | Sup | 12/1/99 | Cable, splices, and terminations. |
| 16130 | RACEWAYS AND BOXES | Basic* | 9/1/99 | Pull, junction, outlet, and cabinets. |
| 16138 | UNDERFLOOR RACEWAYS | Sup | 9/1/99 | Ducts, boxes, fittings, and accessories. |
| 16139 | CABLE TRAYS | Basic* | 9/1/99 | Ladder, trough, solid bottom, and channel types. |
| 16140 | WIRING DEVICES | Basic* | 12/1/96 | Switches, receptacles, and plates. |
| 16145 | LIGHTING CONTROL DEVICES | Basic* | 9/1/97 | Time switches, photoelectric relays, occupancy sensors, and multipole lighting controls. |
| 16215 | ELECTRICAL POWER MONITORING AND CONTROL | Basic* | 3/1/98 | Remote and local monitoring, metering, and control of individual circuits. |
| 16231 | PACKAGED ENGINE GENERATORS | Basic* | 3/1/97 | Reciprocating engine-driven type. |
| 16264 | STATIC UNINTERRUPTIBLE POWER SUPPLY | Basic* | 12/1/98 | Units rated 5 to 750 kVA for systems 600 V and less. |
| 16265 | CENTRAL BATTERY INVERTERS | Sup | 12/1/99 | AC & DC output types. |
| 16269 | VARIABLE FREQUENCY CONTROLIERS | Basic* | 6/1/99 | Adjustable-frequency, pulse-width modulated controllers. |
| 16280 | POWER FACTOR CORRECTION CAPACITORS | Sup | 6/1/98 | Correction capacitors. |
| 16288 | VOLTAGE REGULATORS | Sup | 9/1/96 | Voltage regulators, static electronic voltage regulators, and power distribution units. |
| 16289 | TRANSIENT VOLTAGE SUPPRESSION | Sup | 6/1/98 | Enclosed transient voltage suppression units. |
| 16315 | OVERHEAD ELECTRICAL DISTRIBUTION | Sup | 12/1/98 | Medium and secondary voltage up to 35 kV. |
| 16341 | MEDIUM-VOLTAGE SWITCHGEAR | Sup | 9/1/96 | Switchgear from 5 to 35 kV. |
| 16350 | MEDIUM-VOLTAGE TRANSFORMERS | Sup | 6/1/96 | Transformers - 2.4 to 35 kV. |
| 16361 | SECONDARY UNIT SUBSTATIONS | Sup | 3/1/99 | Step-down medium volts to 600 V. |
| 16410 | ENCLOSED SWITCHES AND CIRCUIT BREAKERS | Basic* | 12/1/98 | Nonfused and fused switches 600 V and less; molded-case circuit breakers. |
| 16415 | TRANSFER SWITCHES | Basic* | 3/1/97 | Automatic, nonautomatic, and bypass/isolation. |
| 16419 | FUSED POWER CIRCUIT DEVICES | Basic* | 3/1/98 | Bolted-pressure and high-pressure contact switches. |
| 16420 | ENCLOSED CONTROLLERS | Basic* | 3/1/99 | Manual, magnetic, and solid state. |
| 16430 | SWITCHGEAR | Sup | 3/1/99 | Materials and accessories. |
| 16441 | PANELBOARDS | Basic* | 6/1/98 | Materials and accessories. |
| 16442 | PANELBOARDS | Basic* | 6/1/98 | Materials and accessories. |
| 16450 | ENCLOSED BUS ASSEMBLIES | Basic* | 3/1/99 | Conventional, modular, freestanding - 600 V. |
| 16461 | DRY-TYPE TRANSFORMERS (1000 V AND LESS) | Basic* | 12/1/96 | Plug-in & feeder - 600 V or less. |
| 16491 | FUSES | Basic* | 6/1/98 | General purpose & specialty dry type - 1000 V and less. |
| 16511 | INTERIOR LIGHTING | Basic* | 6/1/97 | Normal and emergency lighting. |
| 16521 | EXTERIOR LIGHTING | Basic* | 6/1/97 | Exterior luminaires and poles and standards. |
| 16526 | SPORTS LIGHTING | Sup | 6/1/99 | Outdoor lighting for sports fields. |
| 16550 | STAGE LIGHTING | Sup | 6/1/97 | Indoor stage lighting, controls, and accessories. |
| 16570 | DIMMING CONTROLS | Sup | 9/1/97 | Modular dimming and programmable controls. |
| 16715 | PREMISES TELEPHONE WIRING | Basic* | 12/1/96 | Cables and wiring components. |
| 16722 | INTERCOMMUNICATION EQUIPMENT | Basic* | 12/1/96 | Equipment and accessories. |
| 16723 | SCHOOL INTERCOM AND PROGRAM EQUIPMENT | Sup | 12/1/96 | Manually and microprocessor-switched systems. |
| 16725 | NURSE CALL | Sup | 12/1/97 | Patient/nurse communication systems. |
| 16726 | PUBLIC ADDRESS AND MUSIC EQUIPMENT | Basic* | 12/1/96 | Equipment and accessories. |
| 16727 | SOUND-MASKING EQUIPMENT | Basic* | 12/1/96 | Equipment and accessories for acoustical privacy. |
| 16740 | COMMUNICATION AND DATA-PROCESSING EQUIPMENT | Basic* | 3/1/98 | Analog and digital types; premises wire and wiring components. |
| 16850 | TELEVISION EQUIPMENT | Sup | 3/1/98 | Closed-circuit and MATV systems. |
CHAPTER 11 – APPENDICES

APPENDIX 4 – EMERGENCY EVACUATION PROCEDURES
Appendix 4  Emergency Evacuation Procedures
For Persons With Physical Disabilities

4.1 Emergency Evacuation Procedures
  4.1.1 Exiting the Building
  4.1.2 Department Head Responsibility
  4.1.3 Assisting Others
  4.1.4 Accessible Areas of Refuge
  4.1.5 Reporting Emergencies
  4.1.6 Questions
  4.1.7 Services

4.2 Arrangements for Evacuation for Individuals With Special Needs
  4.2.1 Making Arrangements
  4.2.2 Notification of Disabilities

4.3 Responsibilities for Arrangements for Evacuation For Individuals with Special Needs
  4.3.1 Arrangements

4.4 Evacuation and Alternatives
  4.4.1 Alarm Systems – Signaling Devices
  4.4.2 Elevators

4.5 Area of Rescue Assistance
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  4.5.3 Stairways
  4.5.4 Signage

4.6 Definitions
  4.6.1 Area of Rescue Assistance
  4.6.2 Area of Refuge
  4.6.3 Two-Way Communication
Appendix 4  Emergency Evacuation Policy for the Disabled

Division of Public Safety
Emergency Evacuation Policy
And Procedures for Persons with Disabilities

This policy concerns the emergency evacuation of people from buildings. Accessible Areas of Refuge will be made available to protect persons with disabilities during an evacuation.

4.1 Emergency Evacuation Procedures

4.1.1 When a fire alarm is activated, all persons must leave the building as promptly as possible via the nearest available exit. In buildings without an alarm system, all persons must leave whenever it becomes clear that an emergency exists which necessitates evacuation for their own safety. Do not use elevators.

4.1.2 Department heads should develop plans to gather staff together outside the building after an evacuation.

4.1.3 No one is expected to endanger him/herself in order to assist with the evacuation of others, but each person should ensure that other occupants are aware of an emergency. Individuals should aid anyone requiring assistance to safely exit.

4.1.4 Accessible Areas of Refuge will be provided in buildings to offer shelter or protection for persons with disabilities (persons with mobility impairments) during an emergency evacuation (91 NFPA 101/6-1.2.1).

4.1.5 On-campus emergencies should be reported as soon as possible by dialing 911 on any campus telephone to contact University Police, 24 hours a day. The Police non-emergency number is 532-6412.

4.1.6 Questions pertaining to emergency procedures should be referred to the Department of Environmental Health & Safety, 532-5856.

4.1.7 Questions on Americans with Disabilities Act (ADA) accommodations and/or compliance for physically disabled persons should be referred to:

- Disabled Student Services: 532-6441
- University Compliance Office: 532-4392

4.2 Arrangements for Evacuation of Individuals with Special Needs

4.2.1 Arrangements with the department office must be made to reasonably ensure that directions for evacuation are provided to anyone who requires it.

4.2.2 Persons with disabilities may not be readily identifiable. Anyone with a disability should inform the department office of evacuation requirements. Assistance arrangements are private and should not be made public.

4.3 Responsibilities for Arrangements for Evacuation of Individuals with Special Needs
4.3.1 Arrangements for assistance are best accomplished by establishing a personal relationship between the individual requiring assistance and one or more of his or her peers in the form of a “buddy” plan. Redundant arrangements should be made to ensure that assistance would be provided if the primary provider is absent during an emergency. Assistance with making arrangements should be sought from the department office.

4.4 Evacuation and Alternatives

4.4.1 The emergency evacuation alarm systems in most University buildings include visual and audio signaling devices. In residential facilities, signaling components may be added or modified within individuals units to accommodate a resident with a disability.

4.4.2 Elevators must not be used for emergency egress. Many elevators are programmed to cease operation when a fire alarm is activated. A wheelchair can constitute an unacceptable impedance to evacuation, and may have to be abandoned. There are specific techniques to enable two persons to safely carry a third while descending stairs, but these must be learned and practiced prior to an actual emergency.

4.5 Area of Rescue Assistance

4.5.1 An Area of Rescue Assistance will be provided on each level in a number equal to that of inaccessible required exits. Exception: An Area of Rescue Assistance is not required in buildings that have a supervised automatic sprinkler system. (ADA 4.3.11.4)

4.5.2 Areas of Rescue Assistance will be identified within each University building that wheelchair users can reach on their own. While waiting for assistance, emergency egress paths must not be impeded. Emergency service personnel must be made aware of anyone needing assistance. On campus, the stairway landing in most buildings is large enough to accommodate at least one wheelchair occupant and still be viable as a means of emergency egress for others.

4.5.3 While not all stairways fully qualify as “Areas of Rescue Assistance” as defined by fire code, they are usually substantially safer than any other area of the building. Such areas are preferable to remaining in an area where exposure to heat, smoke, and other products of combustion are a hazard. Predetermining and testing an “Area of Rescue Assistance” is an acceptable alternative to assisted evacuation.

4.5.4 Every attempt must be made to provide each Area of Rescue Assistance with appropriate signage, emergency warning devices and a two-way communication system.

4.6 Definitions

4.6.1 AREA OF RESCUE ASSISTANCE: An area which has direct access to an exit, where people who are unable to use stairs may temporarily remain in safety to await further instructions or assistance during emergency evacuation proceedings.

4.6.2 AREA OF REFUGE: An area of refuge is a space protected from the effects of fire, either by means of separation from other spaces in the same building or by
virtue of location in an adjacent building, thereby permitting a delay in egress travel from any level.

4.6.3 TWO-WAY COMMUNICATION: A method of two-way communication, with both visual and audio signals, will be provided between each area of rescue assistance and the primary entrance. The state marshal may approve a location other than the primary entry.
CHAPTER 11 – APPENDICES

APPENDIX 5 – HANDS ON RESTROOM
### SPECIFICATIONS – HANDS ON RESTROOM

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<tr>
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<th>ABBREVIATION</th>
<th>COMPANY</th>
<th>SURFACE MOUNTED</th>
<th>RECESSED MOUNTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Soap Dispenser</td>
<td>HSD</td>
<td>BOBRICK</td>
<td>B-4112 CONTURA</td>
<td>B-4063 CONTURA</td>
</tr>
<tr>
<td>Hand Soap Dispenser (Touchless)</td>
<td>HSD</td>
<td>WORLD DRYER</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Mirror</td>
<td>MIR</td>
<td>BOBRICK</td>
<td>B-290</td>
<td>B-290</td>
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<tr>
<td>Paper Towel Dispenser</td>
<td>PTD</td>
<td>BOBRICK</td>
<td>B-4162 CONTURA</td>
<td>B-4362 CONTURA</td>
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<tr>
<td>Sanitary Napkin Dispenser</td>
<td>SND</td>
<td>BOBRICK</td>
<td>B-4350009X2 CONTURA</td>
<td>B-435002 CONTURA</td>
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<tr>
<td>Sanitary Napkin Receptacle</td>
<td>SNR</td>
<td>BOBRICK</td>
<td>B-279 CONTURA</td>
<td>B-4353 CONTURA</td>
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<tr>
<td>Toilet Seat Cover Dispenser</td>
<td>TCD</td>
<td>BOBRICK</td>
<td>B-4221 CONTURA</td>
<td>N/A</td>
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<tr>
<td>Trash Receptacle</td>
<td>TRASH</td>
<td>BOBRICK</td>
<td>B-277 CONTURA</td>
<td>B-4364 CONTURA</td>
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<tr>
<td>Toilet Tissue Dispenser</td>
<td>TTD</td>
<td>BOBRICK</td>
<td>B-288 CONTURA</td>
<td>B-388 CONTURA</td>
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<tr>
<td>Trash Receptacle/Paper Towel</td>
<td>TPTD</td>
<td>BOBRICK</td>
<td>B-43949 CONTURA</td>
<td>B-43949 CONTURA</td>
</tr>
</tbody>
</table>

| DOOR HARDWARE                   |              |                 |                          |                           |
| Closure – Manual                | LCN CLOSURES | LCN 4041 SERIES | FINISH – CAN BE PLATED   | TRIM – PSR                |
| Handle                          | STANLEY      | FBH268          | METALLIC                 |                           |
| Hinge                           | WILKINSON    | 8” HIGH PLATE   | 11” x 11.75”             | N/A                       |
| Kickplate                       | CORBIN/RUSSWIN | ML2500         | 12.75” x 13.5”           | 12.75” x 13.5”            |
| Lock                             | CORBIN/RUSSWIN | ML2000         | 11.5” x 9.75”            | 11.5” x 9.75”             |
| Threshold                       |               |                 |                          |                           |

| ELECTRICAL ITEMS                |              |                 |                          |                           |
| Electrical Outlet Covers        | WORLD DRYER  | AIRSPEED SERIES | SURFACE – METALLIC      |                           |
| Hand Dryers                     | WORLD DRYER  | AIRSPEED SERIES | RECESSED – METALLIC     |                           |
| Hand Dryers (Touchless)         | WORLD DRYER  | DA SERIES       | SURFACE – STAINLESS STEEL|                           |
| Lights                          | WILLIAMS     | SERIES 15       | SURFACE – METALLIC     |                           |
| Motion Sensors                  | WILLIAMS     | SERIES 16       | SURFACE – WHITE (COLORS AVAILABLE) | 2” x 4” PATTERN 11 |
| Finishes                        | ARMSTRONG    | ARMASHIELD RH90 | FIRE GUARD              |                           |
| Acoustical Tile                 | ARMSTRONG    | FINE FISSURED RH90 | 2” x 2”               |                           |
| Ceiling Tile                    | ARMSTRONG    | ARMASHIELD RH90 | 2” x 2”                 |                           |
| Formica                         | BORRETT      | TEXTURES        | DEPENDS ON GRADE        |                           |
| Mirrors                         | ARMSTRONG    | RUBBER OR VINYL | DEPENDS ON GRADE        |                           |
| Molding                         | ARMSTRONG    | INTERIOR OFF WHITES | 48” TO 160”       |                           |
| Paint                           | ARMSTRONG    | INTERIOR COLORS | N/A                     |                           |
| Fire Guard                      | ARMSTRONG    | ARMASHIELD RH90 | N/A                     |                           |

| TIE                             | ARMSTRONG    | STEP MASTER     | 12” x 12” TILE          | VARIOUS                   |

| OTHER                           |              |                 |                          |                           |
| Book Tacks                      | BOBRICK      | B-296           | 6” x 16” TO 6” x 48”    | STAINLESS STEEL SATIN FINISH |
| Coat Hooks                      | BOBRICK      | B-955           | 5.5” x 18”              | STAINLESS STEEL SATIN FINISH |
| Diaper Changing Stations        | SAFE-STRAP COMPANY | DIAPER-DEPOT   | 25” x 34”               | PLASTIC, COLOR CAN VARY    |

| PLUMBING ITEMS                  |              |                 |                          |                           |
| Faucets                         | CHICAGO FAUCETS | MARATHON 2200 | 4.75”                    | POLISHED CHROME PLATE     |
| Faucets (Touchless)             | SLOAN        | OPTIMA EBF-35   | N/A                     | POLISHED CHROME PLATE     |
| Flush Controls                  | CHICAGO FAUCETS | SELF CLOSING 386-SLO | N/A                     | POLISHED CHROME PLATE     |
| Flush Controls (Touchless)      | SLOAN        | OPTIMA PLUS ROYAL | FLUSHOMETER             | POLISHED CHROME PLATE     |
| Lavatories                      | AMERICAN STANDARD | LUCERNE WALL HUNG | 20.5” x 18.25”          | VARIOUS                   |
| Pipe Shields                    | TRUEBRO      | LAV GUARD       | STANDARD PIPE SIZES     | LIGHT GREY OR CHINA WHITE |

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## SPECIFICATIONS – HANDS ON RESTROOM

<table>
<thead>
<tr>
<th>Category</th>
<th>Company</th>
<th>Model Name</th>
<th>Dimensions</th>
<th>Color</th>
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<tbody>
<tr>
<td>Urinals</td>
<td>American Standard</td>
<td>Washbrook 1.0</td>
<td>18.5&quot; x 14&quot; x 27.25</td>
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<td>Water Closets</td>
<td>American Standard</td>
<td>Madera El 3.5</td>
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<td>Water Coolers</td>
<td>Halsey Taylor</td>
<td>HRF-SER-Q</td>
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<td>Stainless steel, satin finish</td>
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<tr>
<td>Signage</td>
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<td>Accessible Restroom Symbol</td>
<td>KSU Storeroom</td>
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<tr>
<td>Bathroom Gender</td>
<td>KSU Storeroom</td>
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<tr>
<td>Braille Signage</td>
<td>KSU Storeroom</td>
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<tr>
<td>Room Numbers</td>
<td>KSU Storeroom</td>
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<tr>
<td>Toilet Stalls</td>
<td>Company</td>
<td>Model Name</td>
<td>Color</td>
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<td>Santana</td>
<td>Poly-Granite HD</td>
<td>Varies</td>
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<td>Grab Bars</td>
<td>Babrick</td>
<td>B-56799</td>
<td>Stainless steel, satin finish</td>
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<td>Hardware</td>
<td>Santana</td>
<td>Integral Hinge System</td>
<td>N/A</td>
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<td>Partitions</td>
<td>Santana</td>
<td>Poly-Granite HD</td>
<td>Varies</td>
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<td>Department</td>
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<tr>
<td>Cabinets</td>
<td>KSU Carpenter Shop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counter Tops</td>
<td>KSU Carpenter Shop</td>
<td></td>
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</tr>
</tbody>
</table>

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APPENDIX 6 – PREQUALIFICATION REQUIREMENTS
Appendix 6 Supplemental General Conditions

1.0 SCOPE:

It is the intention of the Kansas State University to prequalify prospective companies for anticipated ___________________ work to occur during ______________. The University anticipates the following work schedule:

Prospective vendors are invited to submit documentation of their qualifications for our review. The top five companies, as determined by our evaluation criteria, will be invited to submit proposals for individual projects as they are scheduled. Companies must accept the University’s General Terms and Conditions or successfully negotiate Terms and Conditions before being invited to submit proposals on the individual projects.

2.0 Evaluation Criteria

The following point schedule will be used for selection of the five prequalified vendors. It is the responsibility of the vendor to provide all documentation that they wish to be considered in the evaluation process.

2.1 Experience 25%

The vendor shall provide evidence of a minimum of 25 years experience in the manufacturer and/or repair of ___________________. Specifically describe experience with ____________.

2.2 Field Service Staff 25%

The vendor shall submit resumes of field service representatives who may be assigned to projects at the Kansas State University. Please provide the number of qualified field service representatives employed by your company that have the following levels of industry experience.

5 - 10 years __________
10 - 20 years __________
20+ years __________

2.3 In House Support 25%

The vendor shall provide a complete list of in-house service capabilities. This list should include, but not necessarily be limited to; engineering capabilities, material evaluations, inspection services, shop and field machining capabilities, speed balancing, etc. List the location of shops that would be performing this work.

2.4 References 25%

The vendor shall provide a list of a minimum of 10 customers that may be contacted regarding projects that they have completed. These references should be for customers with equipment similar in type and size to the University’s. This list shall include the name and location of the customer, a detailed description of the work completed, the name, title, address, and phone number of the contact person.

GENERAL CONDITIONS
INCENTIVE AWARD AND DISINCENTIVE ASSESSMENT

Incentive Award

If the ____________________________ project is complete and ready for occupancy by the owner on or before ____________________ the Contractor is eligible for an incentive award. The incentive award shall be made at a rate of _______________________________ ($________) per day for each full calendar day before ___________________. The maximum incentive award available under this provision is limited to 10 calendar days, for a maximum of ____________________________________ ($________). The completion date of ____________ is based on the construction Renovation Timeline indicated on page 3 of Document C – Form of Bid, and a Construction Contract completed ____________________. For the purposes of the incentive clause, no additional days to the contract will be added for any reason, including, but not limited to: weather delays; delays cause by actions of the owner, Architect/Engineer or any other reason. Change orders to the contract shall not revise the completion date for the purpose of incentives.

Disincentive Assessment

If the ______________________________ project is not complete and ready for occupancy by the owner on ________________ the Contractor is liable for a disincentive assessment. The disincentive assessment charged and owing shall be made at a rate of _______________________________ ($______) per day for each calendar day, or part thereof, after ___________________. The maximum disincentive assessment under this provision is limited to 10 calendar days, for a maximum disincentive assessment of ____________________________________ ($_______). If the Contractor does not have the specified work complete and the building ready for occupancy upon the expiration of the 10 calendar day disincentive period, the Contractor shall be liable for liquidated damages as provided for in Document E, 1.02 Article 48, Liquidated Damages.

COMPLETE AND READY

For the purposes of this provision, complete and ready for occupancy shall mean that all work indicated in the construction documents is complete including all deficiencies noted during the final inspection. All building systems shall be operational, and ready for commissioning by the owner.

B. JOB CONDITIONS

Work Location area is defined as the area or all areas within the contract limit as shown on site plan.

Access to the site will be prearranged by the Owner and shown on the Contract Documents. Only designated street access route(s) to construction site will be allowed. Construction access through undesignated streets is prohibited. Contractor's equipment, construction vehicles or any motor vehicles related to project are prohibited from driving anywhere on campus grounds or pedestrian sidewalks outside of the construction, utility extension or storage yard boundary. Contractor shall be responsible for staying on designated streets and parking lots. All cleaning and repair of designated streets, parking lots and storm sewers dirtied or damaged during construction is the Contractor's responsibility.

Only those contractors' vehicles with a valid, displayed KSU parking permit shall be allowed on campus. Any vehicles brought to campus without valid permit shall be removed at Contractor's expense. Only those immediate vehicles and equipment required to complete the work, and marked with contractor's decal, will be allowed on construction site. All other contractor's vehicles shall have parking permits and shall park at the East Bramlage/Wagner Field Parking Lot or as designated by...
Parking Services. Contractors shall provide transportation for their employees between the East Bramlage/Wagner Field Parking Lot (any other specifically designated parking lot) and the project site. The Contractor's personal vehicles are not allowed on the project site or any other campus parking lot. All Contractors' vehicles parked on KSU property are subject to KSU Parking and Traffic Regulations. Permits may be purchased at the Parking Services office located at 128 Burt Hall between 8:00 am and 4:30 p.m. Monday through Friday. The cost of parking permits is $1.00 a day, $4.00 a week, or $10.00 a month. Semi-annual and annual permits are also available. Payment of any citation to Contractor's vehicle is the responsibility of the Contractor. Effective July 1995 three or more unpaid citations may result in impoundment of the vehicle. It is the Contractor's responsibility to ensure their employees compliance with these regulations.

Fire access and emergency egress is to be provided and maintained by the Contractor at all times. For those operable exits that open into the job site, Contractor shall maintain egress through the project per all required codes, and any additional requirements of the State Fire Marshall, at the Contractor's expense. Contractor is responsible for maintaining fire access routes through their project site for fire apparatus to fire hydrants and building sprinkler connections within the construction boundary.

Contractor shall be responsible for daily clean-up of trash on site and construction trash adjacent to the site. Contractor shall be responsible for mowing and trimming on site, as needed. Contractor shall be responsible for protecting trees from damage during construction. The Owner reserves the right to assess a $50/day fine per tree should they not be protected, at any time, during construction. Owner retains the right to request additional work as required to keep the site clean and neat.

Contractor shall be responsible for preventing mud and surface water runoff into adjacent grounds, storm sewers, streets, and sidewalks. Contractor shall keep sidewalks and streets protected and clean of mud, debris and run off by the use of silt fences or other methods approved by Owner. Owner retains the right to request additional work as required to prevent runoff.

C. KSU PEDESTRIAN WALKWAY POLICY

KSU policy states that vehicles shall not drive on campus pedestrian walkways or sidewalks.

D. CONTRACTOR VERIFICATION OF UNDERGROUND UTILITY SERVICES

All specifications and contract documents dealing with underground utilities need to indicate that it is the contractor's responsibility to verify that underground utility connections are being made to active utility lines. An example would be storm sewer lines need to be tested by to contractor prior to their being covered up to verify downstream pipe is open.
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APPENDIX 7 – KANSAS BUILDING FIRE SAFETY HANDBOOK
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APPENDIX 8 – KANSAS STATE FIRE MARSHAL PLAN
SUBMITTAL GUIDELINES
KANSAS LICENSED ARCHITECTS AND ENGINEERS: PLEASE DO NOT SUBMIT COMPLETE CONSTRUCTION DOCUMENTS TO THE KANSAS STATE FIRE MARSHAL FOR REVIEW. READ ON.

Kansas Statutes assign the Kansas State Fire Marshal Office (KSFM) the responsibility of establishing reasonable and uniform regulations to ensure a minimum level of life safety by providing exiting, occupant notification, fire detection, and suppression in buildings. Refer to the matrix on the back page of this guide for the occupancies the KSFM reviews and inspects. These regulations (and others) form the Kansas Fire Prevention Code. In order to meet the intent of the Kansas Fire Prevention Code and other Kansas Statutory requirements new construction (and some changes of building use - see matrix on back page) is required to:

a) be under the direct supervision of a licensed design professional (architect or engineer).

b) be designed and constructed to the criteria established by one of the three model building codes adopted in Kansas regulation.

c) either have plans reviewed for compliance to code intent and/or receive a building permit from a local building and/or fire authority (where available) with building inspections during construction and receive a certificate of occupancy prior to formal use.

Kansas architects, engineers, building code officials, and fire officials shoulder the responsibility for providing third party objective evaluation of the fire safety features of newly constructed buildings. We recognize resources may not be readily available to verify new construction is designed and built to meet the intent of the Kansas Fire Prevention Code. This does not diminish our responsibilities – it only forces creative use of available resources. The three major members of the fire protection team are the building owners & operators, the Kansas State Fire Marshal's Office, and the licensed design professionals. All must work together to facilitate the efficient use of resources – fire protection and life safety features must be included in the original design concept and not "force fit" at a later stage.

The Kansas State Fire Marshal's Office is beginning an effort to capitalize on the effectiveness of plan review to ensure a higher degree of quality in new construction. Architects generate building designs to protect occupant safety and well being, but much of the code criteria used to design and construct the building is not formally recorded. Coherent code inspections are therefore nearly impossible.

This guidance is an effort to change that.

Our objective is to formalize code criteria into a unique format providing a "snap-shot", small scale building plan with key code information shown in a contextual form. The "code footprint" can reduce redundancy and increase coordination of effort among all involved with new construction. Full implementation may take up to five years, and the KSFM will begin the process with a simplified plan review of code footprints for selected buildings the Kansas State Fire Marshal is required to inspect annually. A sample code footprint is included in this guide. A list of information requested to appear on the code footprint is also attached.

Program implementation will include the following steps:

1) Clarify general statutory and regulation requirements with licensed architects.
2) Inform licensed architects of KSFM code footprint submittal requirements.
3) Inform licensed architects of plan review activities conducted by the KSFM.
4) Inform design engineers of the above.
5) Provide notification to regulated community of same (according to inspection priority).
6) Clarify requirements with authorized agents (local fire and building officials).
7) Plan inspections of new construction to verify construction per the submitted footprint.
8) Plan "random audit" inspections of buildings built after a certain time to ensure they are being maintained in accordance with their code footprint and follow up with appropriate enforcement.

KANSAS STATE FIRE MARSHAL/CODE FOOTPRINT FORMAT

All submittals of new buildings and additions to be reviewed and approved by the Kansas State Fire Marshal's Office are required to provide the following information for review and approval in lieu of the construction documents. A separate sheet with a small scale complete floor plan (including existing and new) of each floor of the facility to become part of the construction documents which indicate the following (additionally a reduced copy of the complete information on no larger than 11" x 17" sized sheet):

PLAN INFORMATION REQUIRED
A graphic bar scale/ North arrow.
All permanent partitions 5'-9" or taller.
Each room labeled (Keynoting or legends are acceptable).
Each assembly room shall list its occupant load under room name.
Identify new construction, existing to remain, remodeled area, area relocated.
(Keynoting.)
Stair enclosures & shaft enclosures with minimum fire resistive openings allowed.
The perimeter of all rated corridors with minimum fire resistive openings allowed.
Occupancy separations or protection from hazards.
Fire rated area separation walls dividing diverse construction types or for consideration of portions of a facility as a separate building and required opening ratings.
Horizontal exits or smoke partitions with opening ratings
Fire Department connections/ Fire Department access roads.
Distances to property line and adjoining buildings when within 60 feet.
Location of any anticipated future additions (dotted lines)

NARRATIVE REQUIRED
Indication of which codes the new construction work designed to (UBC and family of codes, BOCA and family of Codes, SBC and family of Codes and any additional state regulations specifically applicable to the building use.)

Type of Construction: New, addition, or renovation, change of use
Location: County, city, street
Owner / Date
Name of Local Fire Department (providing service)
Name of Local Building Inspection Department (when available)

Each portion of a building on each side on a compliant fire resistive area separation wall shall provide narrative information on the submitted sheet related to the following:
Each occupancy group and type
Type of construction
Total area per floor/ approximate grade elevation at each corner of the building and finish floor
Allowed stories and height limitations
(New or existing)

Structural Fire Protection Ratings
Proposed approved assembly numbers
Interior bearing walls
Exterior bearing walls
Exterior nonbearing walls
Structural frame
Permanent partitions
Shaft enclosures
Floors
Roofs
Exterior Openings

Fire Safety: (Sprinklers, standpipes, fire alarms, fire extinguishers, smoke detectors, battery emergency lighting, exit lights, generators, hood systems, or others specify, fire lanes, disconnect switch locations, and fire department connections).
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APPENDIX 8 – KANSAS STATE FIRE MARSHAL PLAN
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   The perimeter of all rated corridors with minimum fire resistive openings allowed.
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   Fire rated area separation walls dividing diverse construction types or for consideration of portions of a facility as a separate building and required opening ratings.
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Fire Department connections/ Fire Department access roads.
Distances to property line and adjoining buildings when within 60 feet.
Location of any anticipated future additions (dotted lines)

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   Indication of which codes the new construction work designed to (UBC and family of codes, BOCA and family of Codes, SBC and family of Codes and any additional state regulations specifically applicable to the building use.)

   Type of Construction: New, addition, or renovation, change of use
   Location: County, city, street
   Owner / Date
   Name of Local Fire Department (providing service)
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   Each portion of a building on each side on a compliant fire resistive area separation wall shall provide narrative information on the submitted sheet related to the following:
      Each occupancy group and type
      Type of construction
      Total area per floor/ approximate grade elevation at each corner of the building and finish floor
      Allowed stories and height limitations
      (New or existing)

   Structural Fire Protection Ratings
      Proposed approved assembly numbers
      Interior bearing walls
      Exterior bearing walls
      Exterior nonbearing walls
      Structural frame
      Permanent partitions
Shaft enclosures
Floors
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APPENDIX 9 – INSTALLATION AND DOCUMENTATION OF SPRINKLER SYSTEMS AND FIRE ALARMS
Appendix 9 Installation & Documentation of Sprinkler Systems & Fire Alarms

Installation and Documentation of Fire Alarm and Sprinkler Systems

I am writing in response to a concern shared by many of us regarding the installation and documentation of fire alarm and sprinkler alarm systems. The following proposal has been crafted for your perusal and comments.

Whenever a fire alarm or sprinkler system has to be modified, added on to, or is newly installed, the following procedure should be considered: (also see attached KSFMO Fire Facts 031 and 045)

**Design Phase** The System Designer, i.e., the architect will design and submit drawings bearing the architects professional seal to the Dept. of Fire Safety Inspections which will forward copies to the State Fire Marshals Office, Dept. of Architectural Services, and other appropriate agencies for technical review.

Comments: Occasionally the above-named offices may not be included in the plans review process and therefore may not be aware of a project's existence.

**Review Phase** After the plans have been reviewed and appropriate comments made, the plans should be returned to the System Designer for further review prior to proceeding on to the installation phase.

**Installation Phase** The system should be installed according to specifications the System Designer delineated on the drawings. The System Designer should monitor the installation process to insure that the plan designs are being adhered to.

**Acceptance Test Phase** Once installed, the system must be tested to insure that all components connected to the system during the installation process are functioning properly.

Comments: The "System Designer" (engineer), the "Installer" (Facilities Personnel or External Contractor), and the "Tester" (Fire Safety Officer responsible for monthly testing) should be present during the Acceptance Test Phase. During this phase, the "System Designer" will be on hand to answer system design questions as well as witness how well the overall system design is suited for this type of application and location. The "Tester" will have an opportunity to learn where the new components and system controls are located. The "Installer" will be available to answer any technical questions regarding the system operations.

**Documentation Phase** During this phase, the NFPA 72-25 form (applicable to fire alarm systems), or the NFPA 13-75 form (applicable to fire sprinkler systems), is completed by the Installer and the Tester should sign the appropriate NFPA documents. (see attached)

Note: The System Designer's professional seal on the plans should suffice as an acknowledgment of responsibility.

Signing the NFPA Forms – The Tester acts as witness and concurs with the Installer that the system functioned properly during the Acceptance Test. The Tester and the Installer signs the NFPA 13-75 (sprinkler systems) or 72-25 in the appropriate locations.

The System Designer will not be required to sign the NFPA document but should be present during the Acceptance Test.

**Documentation Dissemination Phase** After the appropriate NFPA documents have been completed, a copy should be retained by the Installer and the originals should be sent to the Dept. of Fire Safety Inspections for further dissemination to the State Fire Marshals Office, Dept. of Architectural Services and other agencies as required.
Appendix 10  Policy for Handling Asbestos

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Appendix 10  Policy for Handling Asbestos

10.1 Introduction

10.1.1 The U.S. Environmental Protection Agency (EPA), and the Kansas Department of Health and Environment (KDHE) have issued rules and regulations concerning the handling of, or working with, asbestos. Those rules and regulations are summarized below and Kansas State University personnel will comply with the rules.

10.2 Inspection of Buildings for Asbestos

10.2.1 Any building owned by Kansas State University must be properly inspected for the presence of friable and nonfriable asbestos prior to demolition or renovation of the building. Building includes any institutional, commercial, public, industrial, residential or farm structure.

10.2.2 The inspection must be performed by an individual accredited in accordance with the asbestos Model Accreditation Plan (MAP) as stated in the EPA Asbestos School Hazard Abatement Reauthorization Act (ASHARA). The individual designing or conducting asbestos response actions must also be accredited in accordance with the MAP.

10.2.3 National Emission Standards for Hazardous Air Pollutants (NESHAPS) required pre-demolition notification. Ten (10) days prior to demolition of any structure, the EPA must be notified, whether or not asbestos is found in the inspection.

10.3 Asbestos Containing Materials

10.3.1 The potential for an asbestos-containing product to release breathable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure when dry and is therefore likely to emit fibers. The fibrous or fluffy sprayed-on materials used for fireproofing, insulation, or soundproofing are considered to be friable. Materials such as vinyl-asbestos floor tile, roofing felts, or asbestos-cement pipe or sheet (Transite) are considered nonfriable and generally do not emit airborne fibers unless subjected to sanding or sawing operations.

10.3.2 Major (greater than 3 linear or square feet) projects involving the removal and abatement of friable asbestos or materials containing friable asbestos will be handled on a case by case situation. All major asbestos projects shall be coordinated with the Department of Public Safety to ensure compliance with current regulations. The project coordinator must also notify KDHE and the EPA in writing not less than 10 working days before the intended start of the project. Kansas Annotated Regulations (K.A.R.) 28-50-8 provides for waivers in case of an emergency.

10.3.3 Kansas State University personnel certified by the state as asbestos workers may only perform maintenance related work without notification of KDHE. Maintenance related work is any job involving the removal, clean up, or encapsulation of three linear feet or less of friable asbestos from the surface of a pipe or three square feet or less of friable asbestos from any other structure. All maintenance related work shall be coordinated with the Division of Public Safety to ensure compliance with current regulations. All friable asbestos work will be reported in writing to the Division of Public Safety prior to the start of
the job. In the case of emergencies, notification will be by phone immediately followed by a written notification. Please use the Asbestos Maintenance Work form Appendix A (Section 10.12), or a reasonable facsimile.

10.3.4 Each asbestos worker shall be trained in an approved training course in accordance with K.A.R. 28-50-6. Only persons holding a current Kansas Class I or Class II Asbestos Worker certificate may engage in asbestos work in accordance with a K.A.R. 28-50-5. Any Kansas State University department that allows an uncertified individual to engage in asbestos work will be responsible for any fines levied by the EPA, or KDHE, as well as additional costs incurred for air monitoring, surveillance, and asbestos clean up.

10.3.5 Waiver for any individual requirements of these guidelines may be requested from the Division of Public Safety. Waivers will be considered on a case by case determination with approval by KDHE.

10.3.6 Nonfriable asbestos falls outside the state and federal asbestos rules and includes vinyl asbestos floor tile, mastic, transite and any other asbestos material that does not crumble with hand pressure. However, the workers and the public must be adequately protected during all removal procedures.

10.4 Worker Protection

10.4.1 Each asbestos worker shall be examined by a licensed physician within the preceding year and declared by the physician to be physically capable of working while wearing a respirator. The annual medical examination shall include a comprehensive history, a chest X-ray at the discretion of the physician, a pulmonary function test (forced vital capacity ad forced expiratory volume at 1 second) and any other tests the physician requires. A signed statement by the physician shall be submitted to the KDHE at the time of application and a copy shall be maintained by the Division of Public Safety or the employee’s department (K.A.R. 28-50-5-a-1).

10.4.2 The worker’s department will be responsible to pay for the initial and annual medical examination. Physicians of the Lafene Health Center will administer the examination. Workers must use the attached Medical Questionnaire (Appendix B (Section 10.13) for initial exam and Appendix C (Section 10.14) for annual exam).

10.4.3 Respirators shall be worn by all workers while engaged in a maintenance project which disturbs friable asbestos. The respirators must be Mine Safety and Health Administration (MSHA) / National Institute of Occupational Safety and Health (NIOSH) approved for respiratory protection against dust, fumes and mists having an air contamination level less than 0.05 milligrams per cubic meter of air and must include any required attachments and/or filters.

10.4.4 Asbestos workers shall wear appropriate protective clothing to prevent unintentional transfer of asbestos fibers from the work area to other areas including home. Protective clothing shall consist of coveralls, gloves, head covers and foot covers. Protective clothing shall be worn at all times during asbestos work.

10.5 Asbestos Work Practices for Maintenance Jobs

10.5.1 Only certified Kansas Class I or Class II asbestos workers shall be allowed in the work area where asbestos related maintenance work is being performed. An
appropriate danger sign (see Appendix D, Section 10.15) shall be prominently posted at all approaches to the work area until the operation and cleanup is completed (K.A.R. 28-50-1-e).

10.5.2 The walls and floor in the vicinity (not less than six feet from the work site) shall be covered with not less than six-mil thick plastic sheeting. The plastic sheeting shall remain in place until cleanup.

10.5.3 The asbestos material must be wetted with a water solution containing an effective wetting agent prior to being cut, scrapped, removed, or otherwise handled. Power tools are not allowed when working with friable asbestos without prior approval of the Division of Public Safety.

10.5.4 When the job is completed, cleanup shall be done by wet cleaning the surfaces and/or vacuuming with a device equipped with a HEPA filter. This includes all surfaces previously covered by plastic sheeting if there are signs of visible leakage.

10.5.5 All asbestos containing materials that are removed or cleaned from a surface shall be maintained in a wet condition and placed in a sealed container for disposal in accordance with K.A.R. 28-50-14. This includes the plastic sheeting, protective clothing, and respirator cartridges used during the job.

10.5.6 All visible asbestos residue must be cleaned and removed. Any asbestos material left exposed after the job is completed, and surfaces once covered by asbestos shall be covered and sealed with a pigmented sealant before the area can be occupied by persons other than the asbestos workers.

10.5.7 Asbestos workers shall be provided with and shall wear an appropriate respirator and protective clothing while performing the operation. Outer clothing shall be cleaned with a HEPA filter equipped vacuuming device or by wet cleaning methods or removed before the persons move from the plastic sheeting placed on the floor.

10.6 Asbestos Work Practices Using Glove Bags

10.6.1 Each asbestos worker using the glove bag shall avoid damaging other friable asbestos containing materials located in the work area. Damaged sections of pipe or conduit from which the friable asbestos containing material is to be removed that is not immediately enclosed within a glove bag shall be tightly enclosed in six mil thick plastic sheeting until a glove bag is placed over it and the asbestos containing material is removed.

10.6.2 Glove bags shall be sealed to pipe or conduit to provide an airtight seal around the area to be removed.

10.6.3 All exposed surfaces of friable asbestos containing materials shall be wetted as per item 10.5.3 above and maintained in a wet condition until the bag is sealed for final disposal.

10.6.4 All other work practices as outlined in Section 10.5 are to be followed as directed.

10.7 Asbestos Work for Greater than Maintenance Jobs

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10.7.1 Only certified Kansas Class I or Class II asbestos workers shall be allowed in the work area where asbestos abatement is being performed. An appropriate danger sign shall be prominently posted at all approaches into the area until the operation and cleanup is completed (K.A.R. 28-50-1-e).

10.7.2 Three ante rooms attaching to the work area.

10.7.2.1 Clean Room – large enough to house all clean, non-contaminated supplies and changing room for personnel.

10.7.2.2 Shower Room – Self-contained shower with hot and cold running water, drain, and adequate soap for washing.

10.7.2.3 Equipment Room – large enough to house all contaminated equipment, clothing waste, and changing room for personnel.

10.7.2.4 These ante rooms must have one layer of 4 mil thick plastic sheeting covering their frames and three layers plastic sheeting acting as entry doors before, between, and after the rooms.

10.7.3 A HEPA air filtering device shall be added to the system to effectively create a negative air pressure in the work area. The exhaust of the HEPA air filtering device shall be vented to outside the building. All air passing to the outside must first pass through a HEPA filter. The HEPA air filtering unit may be placed inside or outside the work area.

10.7.4 All equipment and furniture must be cleaned using wet techniques or a High Efficiency Particulate Air (HEPA) filtered vacuum and removed from the work area, if possible. All surfaces not being abated and non-moveable equipment or furniture must be cleaned using wet techniques or a HEPA vacuum.

10.7.5 All surfaces not on the asbestos abatement schedule in the work site shall be covered with one layer of four mil thick plastic sheeting on the walls and two layers of six mil thick plastic sheeting on the floor. The plastic sheeting shall remain in place until cleanup.

10.7.6 The work area will only be entered and exited via the ante rooms. Respirators must be worn while inside the work area, the equipment room, and the shower room. There will be no eating, drinking, smoking, or using smokeless tobacco once in the ante rooms and the work area.

10.7.7 The asbestos material to be abated must be wetted with a water solution containing an effective wetting agent prior to being cut, scrapped, removed, or otherwise handled.

10.7.8 Any asbestos material left exposed after the job is completed, and surfaces once covered by asbestos shall be covered and sealed with a pigmented sealant.

10.7.9 When the job is completed, the first layer of plastic sheeting must be cleaned by wet cleaning the surfaces and/or HEPA vacuum or completely removed.

10.7.10 After the plastic sheeting has been removed, all previously covered surfaces must be cleaned by wet cleaning or by HEPA
vacuum.

10.7.11 Not less than 24 hours after completing the above step, an air stream from a high speed leaf blower shall be swept across all cleaned surfaces for a minimum of five minutes per 1,000 square feet of area. Fan(s) must be operated in the area during the next 24 hours to maintain air currents in the work space.

10.7.12 After 24 hours, a sample of air must be taken using standard methods for asbestos air monitoring. This sample will be considered the clearance sample.

10.7.12.1 Members of the Division of Public Safety or their designee will enter the work area, inspect the area for asbestos contamination, and take the sample.

10.7.12.2 The individual assigned the task must be adequately trained to inspect the area, take the sample, and must at least be a Class I asbestos worker.

10.7.12.3 Air samples will be collected using a high air flow sampling pump. At least 2,000 liters of air will be sampled for clearance sampling.

10.7.13 The work area will be considered clean only if the clearance sample has a fiber concentration of less than 0.009 fibers/cm³ or none detected (ND). If the clearance sample is greater than 0.009 fibers/cm³, the work area must be re-cleaned or additional air samples taken, whichever the Division of Public Safety deems necessary.

10.7.14 All asbestos-containing materials that are removed or cleaned from a surface shall be maintained in a wet condition and placed in a sealed container for disposal in accordance with K.A.R. 28-50-14. This includes the plastic sheeting used during the job and all contaminated disposable supplies.

10.8 Work Practices for Nonfriable Asbestos

10.8.1 Safe work practices must be followed in any job requiring the handling of nonfriable asbestos. To protect the public, limit access to only essential personnel.

10.8.2 Each nonfriable asbestos job must be handled as a case-by-case situation and must therefore request approval by the Division of Public Safety prior to the start of the job. More stringent worker practices in the situation of ‘about to become friable’ material or more restricted access to the public may be required.

10.8.3 The nonfriable asbestos should be removed using hand operations and completely wetting down the area. The use of mechanical chipping devices to remove nonfriable asbestos materials is not recommended for all situations. Besides wetting down the area, the materials should be constantly misted with water during removal and disposal into waste containers. The waste should be collected and disposed as nonfriable asbestos in the sanitary landfill.
10.8.4 As a minimum, all workers on the project must attend a 90-minute training session on asbestos safety. This must be arranged prior to the start of work.

10.9 Disposal of Friable Asbestos Materials

10.9.1 All friable asbestos materials shall be placed in tightly sealed containers in a wet condition before they are removed from the work area. Waste containers must be double bagged in not less than 6 mil thick plastic bags. Plastic bags may be placed into fiber or metal containers with airtight fitting lids which can be fastened firmly in position.

10.9.2 The exterior surface of each container shall be cleaned free of all visible residue. An asbestos caution label shall be securely attached to each container before its removal from the work area.

10.9.3 The material shall be transported to the landfill under permit number 94-587. This permit is for use by Kansas State University employees only and is not to be used by outside contractors. Asbestos waste must be completely sealed during transportation to the landfill to prevent asbestos fiber loss. The proper Department of Transportation (DOT) labeling and marking must be affixed to each container of asbestos waste.

10.9.4 Waste water from cleanup of asbestos removal projects shall be mixed with the solid waste and disposed with the asbestos. Waste water from decontamination showers and final cleanup of equipment may be disposed of in public sewer systems by discharge into the plumbing system. The wastewater shall be free of any material that is likely to cause stoppage in the plumbing or sewer systems.

10.9.5 Discharge of other waste water not identified in item 10.9.4 above from asbestos related projects must have the approval of KDHE.

10.10 Respirator Protection Program

10.10.1 A written, standard-operating procedure is required by the Worker Protection Regulation, Title 40 Code of Federal Regulations (CFR) 763, subpart G. to provide a document which can be used to administer an effective respiratory protection program, and to provide the information, training, and equipment necessary for proper respiratory protection for asbestos removal.

10.10.1.1 Each Kansas State University department is responsible for the establishment and maintenance of the KSU respiratory program.

10.10.1.2 The Division of Public Safety has overall University responsibility for the program and has authority to make the technical and administrative decisions necessary for the continued success of the program.

10.10.1.3 Each employee shall use only respirators issued or approved by the University in accordance with the training received; the employee shall guard against damage to the respirators and to report any malfunction to their supervisors.

10.10.2 Selection and Use of Respirators for Asbestos Work
10.10.2.1 All available respirators shall be approved by NIOSH for protection against airborne asbestos.

10.10.2.2 The selection of respirators depends upon the airborne concentration of asbestos fibers. The minimum levels of respiratory protection are given below:

<table>
<thead>
<tr>
<th>Respirator Type</th>
<th>Maximum Asbestos Concentration 8-HR TWA *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half-Mask, Air-Purifying</td>
<td>2.0 Fibers/cc</td>
</tr>
<tr>
<td>Full-Face, Air-Purifying</td>
<td>2.0 Fibers/cc</td>
</tr>
<tr>
<td>Powered-Air Purifying or continuous flow airline</td>
<td>20.0 Fibers/cc</td>
</tr>
<tr>
<td>Full-face Pressure on Demand Airline</td>
<td>200.0 Fibers/cc</td>
</tr>
<tr>
<td>Full-face Continuous-flow, supplied air equipped with auxiliary Self Contained Breathing Apparatus (SCBA)</td>
<td>Greater than 200.0 Fibers/cc or unknown concentration</td>
</tr>
</tbody>
</table>

* Respiration protection factor using a Qualitative Fit Test based on a Time Weighted Average (TWA)

10.10.2.3 Respirators meeting the above minimum protection requirements are required. Respirators with higher levels of protection may be used.

10.10.2.4 Adequate respiratory protection shall be worn during all asbestos related jobs including:

10.10.2.4.1 all pre-removal activities when the possibility of exposure to airborne asbestos fibers exists;

10.10.2.4.2 all removal activities;

10.10.2.4.3 all clean-up, decontamination, and disposal activities, until the final clearance level has been met;

10.10.2.4.4 disposal at the landfill to avoid exposure if the potential for an asbestos container rupture exists.

10.10.3 Procedures for Wearing Respirators for Asbestos Work.

10.10.3.1 Air-Purifying Respirators.

10.10.3.1.1 Only a clean, sanitized, and inspected respirator shall be worn.

10.10.3.1.2 The respirator shall be properly donned in the
Clean Area, prior to putting on disposable hoods or any other articles worn on the head or neck.

10.10.3.1.3 Prior to leaving the Clean Area, a positive and negative pressure check shall be performed. If successful, any remaining clothing and equipment can be donned, and the worker can proceed to the duties. If not successful, the worker will contact the job supervisor. A qualitative fit test may be required at any time.

10.10.3.1.4 Each time the worker exits the work area, the respirator is worn into the shower, and the respirator is thoroughly soaked before it is removed.

10.10.3.1.5 The respirator is then removed and the filters placed in the labeled receptacle.

10.10.3.1.6 Any visible contamination is washed from the respirator, and the respirator is placed in the labeled receptacle.

10.10.3.1.7 After removing the respirator, the worker showers and proceeds to the Clean Area.

10.10.3.2 Powered-Air Purifying Respirators

10.10.3.2.1 Only a clean and inspected respirator shall be worn. If shared use, the respirator shall also be sanitized before being worn.

10.10.3.2.2 The respirator shall be properly donned in the Clean Area, prior to putting on disposable hoods or any other articles worn on the head or neck.

10.10.3.2.3 Prior to leaving the Clean Area, a fit test shall be performed. If successful, any remaining clothing and equipment can be donned, and the worker can proceed to the duties. If not successful, the worker will check the respirator, re-don the device, and again perform a negative or positive pressure check. If successful, the worker will don any remaining clothing and equipment and proceed with the duties. If the check is still unsuccessful, an alternative respirator should be worn.

10.10.3.2.4 Each time the worker exits the work area, the battery pack is carefully held while the worker removes disposable clothing in the Equipment Room.

10.10.3.2.5 The worker then shuts off the battery pack and places it into the designated plastic bag. The battery pack is still connected to the respirator. Clean air is still
being supplied to the worker, but the respirator is now a negative-pressure device.

10.10.3.2.6 The worker proceeds into the shower and carefully holds closed the plastic bag at the point where the breathing tube connects to the battery pack.

10.10.3.2.7 The worker then soaks the respirator and exposed breathing tube.

10.10.3.2.8 After the exposed respirator parts are soaked, the respirator is removed, and the breathing tube is carefully disconnected from the battery pack, while holding the top shut.

10.10.3.2.9 The battery pack is secured with the closure provided and placed in the labeled receptacle.

10.10.3.2.10 Any visible contamination is washed from the respirator, and the respirator is then placed in the labeled receptacle.

10.10.3.2.11 After removing the respirator, the worker showers and proceeds to the Clean Area.

10.10.3.3 Airline Respirators

10.10.3.3.1 Only a clean, sanitized and inspected respirator shall be worn.

10.10.3.3.2 The respirator shall be properly donned in the Clean Area, prior to putting on disposable hoods or any other articles worn on the head or neck.

10.10.3.3.3 Prior to leaving the Clean Area, the airline will be connected to the respirator.

10.10.3.3.4 Each time the worker exits the work area, the respirator remains on while the worker removes disposable clothing in the Equipment Room.

10.10.3.3.5 The respirator is worn into the shower, and thoroughly soaked before it is removed.

10.10.3.3.6 All visible contamination is washed from the device, the airline is disconnected, and the respirator is placed in the labeled receptacle.

10.10.3.3.7 After removing the respirator, the worker showers and proceeds to the Clean Area.

10.10.4 Respirator Limitations

10.10.4.1 Air-purifying respirators and Powered-Air Purifying
Respirators (PAPR) are to be used only in atmospheres that are not oxygen-deficient, atmospheres that are not Immediately Dangerous to Life or Health (IDLH), and atmospheres that do not exceed the protection factors listed in paragraph 10.10.2.2 above.

10.10.4.2 Airline respirators are to be used only in atmospheres that are not IDLH.

10.10.5 Donning Air-Purifying Respirators:

10.10.5.1 Check to ensure that all required parts are present and intact.

10.10.5.2 Check to ensure that the device is clean.

10.10.5.3 Place the device over the face by first fitting the chin into the respirator and pulling the facepiece to the face.

10.10.5.4 Position the headbands around the crown of the head and the back of the neck.

10.10.5.5 Adjust the headbands, beginning with the lowest ones, until a tight, but comfortable fit is obtained.

10.10.5.6 Perform a negative or positive pressure check. Each time a respirator is donned, a negative or positive pressure check is done by the wearer:

10.10.5.6.1 Negative check – Place the palms of the hands over each filter to seal off the inhalation valves. Inhale slightly to create a negative pressure inside the facepiece. If no air escapes, proceed with the job duties. If air escapes, readjust the respirator and check again.

10.10.5.6.2 Positive check – Place the palm of the hand or the thumb over the exhalation valve cover and press lightly. Exhale slightly to create a positive pressure inside the facepiece. If no air escapes, proceed with the job duties. If air escapes, readjust the respirator and check again.

10.10.6 Donning Powered-Air Purifying Respirators:

10.10.6.1 Check to ensure that all required parts are present and intact.

10.10.6.2 Check to ensure that the device is clean.

10.10.6.3 Place the device over the face by first fitting the chin into the respirator and pulling the facepiece to the face.

10.10.6.4 Position the headbands around the crown of the head and the back of the neck.

10.10.6.5 Adjust the headbands, beginning with the lowest ones,
until a tight, but comfortable fit is obtained.

10.10.6.6 Perform a fit test. Each time respirator is donned a fit test is done by the wearer. The palm of the hand is placed over the end of the breathing tube, and the wearer inhales slightly, creating negative pressure inside the facepiece. If no air escapes, proceed with the job duties. If air escapes, readjust the respirator and check again.

10.10.6.7 The breathing tube is then connected to a fully-charged battery pack, and the back is fastened to the small of the back.

10.10.7 Donning Airline Respirators:

10.10.7.1 The hood is placed over the head.

10.10.7.2 The airline is connected prior to leaving the Clean Area.

10.10.8 Donning Helmet Type Respirators:

10.10.8.1 Check to ensure all required parts are present and intact.

10.10.8.2 Check to ensure the device is clean.

10.10.8.3 Fit the filter unit and/or power pack around the waist.

10.10.8.4 After adjusting the helmet to fit snugly on the head, the helmet is placed on the head and the chin strap tightened under the chin.

10.10.8.5 The face shield is snapped down into position, with the chin protector fitting under the chin and covering any facial hair.

10.10.8.6 The power is turned on prior to leaving the clean area.

10.10.9 Respirator Fit Testing

10.10.9.1 Qualitative fit testing is conducted for air-purifying respirators.

10.10.9.2 The procedure is done prior to issuing a worker with a respirator and every six months.

10.10.9.3 Test procedure.

10.10.9.3.1 The worker dons the respirator (equipped with HEPA and/or acid/gas filters) and must successfully pass a negative or positive pressure check before proceeding.

10.10.9.3.2 The worker is allowed to wear the respirator for at least 10 minutes before beginning the test.

10.10.9.3.3 The test procedure is reviewed with the worker.

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10.10.9.3.4 Both ends of the ventilation smoke tube (stannic oxychloride) are broken.

10.10.9.3.5 A short length of tubing is attached to one end of the tube, and the other end is attached to a low flow pump set to deliver 200 cc/minute or some other air pumping device.

10.10.9.3.6 Instruct the subject to keep his or her eyes closed during the test, and the test is conducted within an enclosure.

10.10.9.3.7 Direct the stream of smoke toward the face-to-facepiece seal, beginning 12 inches away and gradually moving to within one inch of the respirator.

10.10.9.3.8 Perform the following exercises while the deal is being tested. Each exercise is performed for one minute:

(1). Normal breathing.

(2). Deep breathing (deep and regular).

(3). Turning head from side-to-side, while inhaling.

(4). Nodding head up-and-down, while inhaling.

(5). Talking. Talk aloud and slowly for several minutes or counting to 100.

(6). Jogging in place.

(7). Normal breathing.

10.10.9.3.9 If the irritant smoke produces an involuntary cough, stop the test. In this case, the respirator is either rejected, readjusted and retested, or another respirator is selected and tested.

10.10.9.3.10 Each person who passes the test is given a sensitivity check of the smoke from the same tube to determine if he or she reacts to the smoke. Failure to evoke a response voids the fit test.

10.10.10 Respirator Cleaning, Maintenance and Storage Procedures.

10.10.10.1 Cleaning:

10.10.10.1.1 Labeled receptacles, which contain the manufacturer’s recommended cleaning solution, are maintained in the shower.

10.10.10.1.2 The facepieces are removed from the receptacles and are disassembled.

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10.10.10.3  All parts are washed in warm soapy water, and visible residue is removed with a brush.

10.10.10.4  The parts are rinsed in clean water and allowed to air-dry.

10.10.10.2  Inspection:

10.10.10.2.1  All parts are inspected for dirt, residue, pliability of rubber, deterioration and cracks, tears, and holes.

10.10.10.2.2  The valves are checked for holes, warpage, cracks, and dirt.

10.10.10.2.3  Check hoods, helmets, and faceshields for cracks, tears, abrasions, and distortions.

10.10.10.2.4  Check air supply for air quality, breaks or kinks in the supply hoses and detachable coupling attachments, tightness of connectors, and manufacturer’s recommendations concerning the proper setting of regulators and valves.

10.10.10.2.5  Check that couplings are compatible with other couplings used on the site.

10.10.10.2.6  Check the air purifying elements, carbon monoxide alarm, and high temperature shut-off.

10.10.10.3  Storage:

10.10.10.3.1  All cleaned and inspected respirators are stored in plastic bags in the Clean Area.

10.10.10.3.2  The devices are stored in a normal position.

10.10.10.4  Special Procedures for Airline Respirators

10.10.10.4.1  Air pumps are routinely used for airline respirators. The intake must be located in a clean, temperature controlled air source.

10.10.10.4.2  Compressed breathing air is tested weekly with a Draeger Aerotest Kit or compatible air test to insure that the following air purity standards are met:

   (1). Oxygen = 19-23%
   (2). Carbon Monoxide = 20 ppm
   (3). Hydrocarbon = 5 mg/m3
   (4). Carbon Dioxide = 1,000 ppm
10.10.10.4.3 The individual performing the tests will be technically competent.

10.10.10.4.4 The test results are recorded in the Test Log.

10.10.11 Respirator Training

10.10.11.1 Supervisor Training: Each year, supervisors must be trained in:

10.10.11.1.1 Basic respiratory protection practices;

10.10.11.1.2 Selection and use of respirators for protection from airborne asbestos fibers;

10.10.11.1.3 The nature and extent of the hazards to which workers are exposed;

10.10.11.1.4 The structure and operation of the entire respiratory protection program; and

10.10.11.1.5 The legal requirements pertinent to the use of the respirators.

10.10.11.2 Employee Training: Each year, workers must be trained in:

10.10.11.2.1 The nature and extent of the inhalation hazards of chemicals, mists, and dusts including asbestos;

10.10.11.2.2 An accurate account of what may happen if the proper device is not worn correctly;

10.10.11.2.3 An explanation of why respirators are necessary;

10.10.11.2.4 A discussion of why these devices are the proper types for the job;

10.10.11.2.5 A discussion of the capabilities and limitations of the respirators;

10.10.11.2.6 Instruction and training in actual use and frequent supervision to assure that the devices continue to be used properly;

10.10.11.2.7 An opportunity to: handle the respirator, have the respirator properly fitted, test the face-facepiece seal, wear the device in normal air for a long familiarity period, and wear the respirator in a test atmosphere.
10.11 References


INITIAL MEDICAL QUESTIONNAIRE

1. NAME _____________________________________________________________
2. SSN _______________________________________________________________
4. PRESENT JOB TITLE ________________________________________________
5. DEPARTMENT _____________________________________________________
6 & 7. BUILDING ______________________________________________________
Kansas State University, Manhattan, Kansas 66506
8. PHONE (785) 532-____________________________________________________
9. INTERVIEWER _____________________________________________________
10. DATE ____________________________________________________
11. Date Of Birth (Month, Day, Year) ___________________________________
12. Place of Birth ____________________________________________________

OCCUPATIONAL HISTORY:
17A. Have you ever worked full time (30 hours per week or more) for 6 months or more? Yes _______ No _______

IF YES TO 17A:
17B. Have you ever worked for a year or more in any dusty job? Yes _______ No _______ Does not apply _______
Specify job/industry ___________________________________________________
Total Years Worked _______
Was dust exposure: Mild _______ Moderate _______ Severe _______

17C. Have you ever been exposed to gas or chemical fumes in your work? Yes _______ No _______
Specify job/industry ___________________________________________________
Total Years Worked _______
Was exposure: Mild _______ Moderate _______ Severe _______

17D. What has been your usual occupation or job – the one you have worked at the longest?
1. Job/occupation _____________________________________________________
2. Number of years employed in this occupation ______________________
3. Position/job title _________________________________________________
4. Business, field or industry _________________________________________

(Record on lines the years you have worked in any of these industries, e.g. 1960-1969)

17 E-J. Have you ever worked:
E. In a mine? Yes _______ No _______
F. In a quarry? Yes _______ No _______
G. In a foundry? Yes _______ No _______
H. In a pottery? Yes _______ No _______
I. In a cotton, flax or hemp mill? Yes _______ No _______
J. With asbestos? Yes _______ No _______

18. PAST MEDICAL HISTORY
18A. Do you consider yourself to be in good health? Yes _______ No _______
If ‘NO’ state reason ____________________________________________________

18B. Have you any defect of vision? Yes _______ No _______

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If ‘YES’ state nature of defect ________________________________________

18C. Have you any hearing defect? Yes _____ No _____
If ‘YES’ state nature of defect ________________________________________

18D. Are you suffering from or have you ever suffered from:
   a. Epilepsy (or fits, seizures, convulsions)? Yes _____ No _____
   b. Rheumatic fever? Yes _____ No _____
   c. Kidney disease? Yes _____ No _____
   d. Bladder disease? Yes _____ No _____
   e. Diabetes? Yes _____ No _____
   f. Jaundice? Yes _____ No _____

19. CHEST COLDs AND CHEST ILLNESSES
19A. If you get a cold, does it usually go to your chest? (Usually means more than ½ the time) Yes _____ No _____ Don’t get colds __________

20A. During the past 3 years, have you had any illnesses that have kept you off work, indoors at home, or in bed? Yes _____ No _____

IF YES TO 20A:
20B. Did you produce phlegm with any of these chest illnesses? Yes _____ No _____ Does Not Apply __________

20C. In the last 3 years, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses _______
   No such illness _______

21. Did you have any lung trouble before the age of 16? Yes _____ No _____

22. Have you ever had any of the following?
   1A. Attacks of bronchitis? Yes _____ No _____
      IF YES TO 1A:
      B. Was it confirmed by a doctor? Yes _____ No _____
      C. At what age was your first attack?
         Age in Years _______ Does Not Apply _______
   2A. Pneumonia? (include bronchopneumonia)? Yes _____ No _____
      IF YES TO 2A:
      B. Was it confirmed by a doctor? Yes _____ No _____
         Does Not Apply _______
      C. At what age did you first have it? Age in Years _______
         Does Not Apply _______
   3A. Hay Fever? Yes _____ No _____
      IF YES TO 3A:
      B. Was it confirmed by a doctor? Yes _____ No _____
         Does Not Apply _______
      C. At what age did it start? Age in Years _______
         Does Not Apply _______

23A. Have you ever had chronic bronchitis? Yes _____ No _____
   IF YES TO 23A:
   B. Do you still have it? Yes _____ No _____ Does Not Apply _______
   C. Was it confirmed by a doctor? Yes _____ No _____
      Does Not Apply _______
   D. At what age did it start? Age in Years _______
      Does Not Apply _______

24A. Have you ever had emphysema? Yes _____ No _____
IF YES TO 24A:
   B. Do you still have it?   Yes _____  No _____  Does Not Apply_____
   C. Was it confirmed by a doctor?   Yes _____  No _____
       Does Not Apply ______
   D. At what age did it start?   Age in Years _______  Does Not Apply ______

25A. Have you ever had asthma?   Yes _____  No ______
IF YES TO 25A:
   B. Do you still have it?   Yes _____  No _____  Does Not Apply ______
   C. Was it confirmed by a doctor?   Yes _____  No _____
       Does Not Apply ______
   D. At what age did it start?   Age in Years _______  Does Not Apply ______
   E. If you no longer have it, at what age did it stop?
       Age stopped _______  Does Not Apply ______

26. Have you ever had:
   A. Any other chest illness? Yes _____  No _____
       If yes, please specify _______________________________________________
   B. Any chest operations?   Yes _____  No ______
       If yes, please specify _______________________________________________

27A. Has a doctor ever told you that you had heart trouble?   Yes _____  No _____
IF YES TO 27A:
   B. Have you ever had treatment for heart trouble in the past 10 years?
       Yes _______  No ______

28A. Has a doctor ever told you that you had high blood pressure?  Yes _______
       No ______
IF YES TO 28A:
   B. Have you had any treatment for high blood pressure (hypertension) in the past
       10 years? Yes _______  No _______  Does Not Apply ______

29. When did you last have your chest X-rayed? (year) _________________________

30  Where did you last have your chest X-rayed? (if known) _____________________
What was the outcome? ___________________________________________________

FAMILY HISTORY
31. Were either of your natural parents ever told by a doctor that they had a chronic lung condition such as
    (circle correct answer):
   A. Chronic Bronchitis? Yes ___ No ____ Don’t Know ____ (Father or Mother)
   B. Emphysema? Yes ____ No ____ Don’t Know ____ (Father or Mother)
   C. Asthma? Yes ____ No ____ Don’t Know ____ (Father or Mother)
   D. Lung Cancer? Yes ____ No ____ Don’t Know ____ (Father or Mother)
   E. Other Chest Conditions? Yes ___ No ____ Don’t Know ____ (Father or Mother)
   F. Is parent currently alive? Yes ____ No ____ Don’t Know ____ (Father or Mother)
   G. Please specify:
       Father, age if living _____ Age at death ______   Don’t know ___
       Mother, age if living ______   Age at death _______   Don’t know _____

H. Please specify cause of death

COUGH
32A. Do you usually have a cough? (Count a cough with first smoke or on first going out of doors. Exclude clearing of throat.) [If no, skip to question 32C.]
   Yes _____ No _____

B. Do you usually cough as much as 4 to 6 times a day 4 or more days out of the week?
   Yes _____ No _____

C. Do you usually cough at all on getting up or first thing in the morning?
   Yes _____ No _____

D. Do you usually cough at all during the rest of the day or at night?
   Yes _____ No _____

IF YES TO ANY OF ABOVE (32A, B, C, OR D) ANSWER THE FOLLOWING. IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.

E. Do you usually cough like this on most days for 3 consecutive months or more during the year? Yes _____ No _____ Does Not Apply _____

F. For how many years have you had the cough?
   Number of Years _____ Does Not Apply _____

33A. Do you usually bring up phlegm from your chest? (Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm.) Yes _____ No _____ Does Not Apply _____

(IF NO SKIP TO 33C)

B. Do you usually bring up phlegm like this as much as twice a day 4 or more days out of the week?
   Yes _____ No _____ Does Not Apply _____

C. Do you usually bring up phlegm at all on getting up or first thing in the morning?
   Yes _____ No _____ Does Not Apply _____

D. Do you usually bring up phlegm at all during the rest of the day or at night?
   Yes _____ No _____ Does Not Apply _____

IF YES TO ANY OF THE ABOVE (33A, B, D, OR D), ANSWER THE FOLLOWING; IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.

E. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? Yes _____ No _____ Does Not Apply _____

F. For how many years have you had trouble with phlegm?
   Number of years _____ Does Not Apply _____

EPISODES OF COUGH AND PHLEGM
34A. Have you had periods or episodes of (increased*) cough and phlegm lasting for 3 weeks or more each year? Yes _____ No _____
* (For persons who usually have cough and/or phlegm)

IF YES TO 34A
B. For how long have you had at least 1 such episode per year?
   Number of Years _____ Does Not Apply _____

WHEEZING
35A. Does your chest ever sound wheezy or whistling?
   1. When you have a cold? Yes _____ No _____
   2. Occasionally apart from colds? Yes _____ No _____
   3. Most days or nights? Yes _____ No _____

IF YES TO 1, 2, OR 3 IN 35A
B. For how many years has this been present?
   Number of Years _____ Does Not Apply _____

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36A. Have you ever had an attack of wheezing that has made you feel short of breath?
   Yes _____   No _____

IF YES TO 36A
B. How old were you when you had your first such attack?
   Age in Years _____   Does Not Apply _____
C. Have you had 2 or more such episodes?   Yes _____   No _____
   Does Not Apply _____
D. Have you ever required medicine or treatment for the(se) attack(s)?
   Yes _____   No _____   Does Not Apply _____

BREATHELESSNESS
37. If disabled from walking by any condition other than heart or lung disease, please describe and proceed
to question 39A.
   Nature of condition(s) _____________________________________________________
   _______________________________________________________________________

38A. Are you troubled by shortness of breath when hurrying on the level or walking up a short hill?
   Yes _____   No _____

B. Do you have to walk slower than people at your age on the level because of breathlessness?   Yes _____   No _____   Does Not Apply _____

C. Do you ever have to stop for breath when walking at your own pace on the level?
   Yes _____   No _____   Does Not Apply _____

D. Do you ever have to stop for breath when walking at your own pace on the level?
   Yes _____   No _____   Does Not Apply _____

E. Are you too breathless to leave the house or breathless on dressing or climbing one flight of stairs?
   Yes _____   No _____   Does Not Apply _____

TOBACCO SMOKING
39A. Have you ever smoked cigarettes? (No means less than 20 packs of cigarettes or 12 oz. of tobacco in
   a lifetime or less than 1 cigarette a day for a year.)
   Yes _____   No _____

IF YES TO 39A
B. Do you now smoke cigarettes (as of one month ago)?
   Yes _____   No _____   Does Not Apply _____

C. How old were you when you first started regular cigarette smoking?
   Yes _____   No _____   Does Not Apply _____

D. If you have stopped smoking cigarettes completely, how old were you when you stopped?   Age
   stopped _____   Check if still smoking _____
   Does Not Apply _____

E. How many cigarettes do you smoke per day now?
   Cigarettes per day _____   Does Not Apply _____

F. On the average of the entire time you smoked, how many cigarettes did you smoke per day?
   Cigarettes per day _____   Does Not Apply _____

G. Do or did you inhale the cigarette smoke?
   Does Not Apply _____

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40A. Have you ever smoked a pipe regularly? (Yes means more than 12 oz. of tobacco in a lifetime.) Yes _____ No _____

IF YES TO 40A:
FOR PERSONS WHO HAVE EVER SMOKED A PIPE
B1. How old were you when you started to smoke a pipe regularly? Age _____
2. If you have stopped smoking a pipe completely, how old were you when you stopped?
   Age stopped _____  Check if still smoking pipe _____ Does Not Apply _____
C. On the average over the entire time you smoked a pipe, how much pipe tobacco did you smoke per week? _____ oz. per week (a standard pouch of tobacco contains 1 ½ oz.)
D. How much pipe tobacco are you smoking now? _____ oz. per week
   Not currently smoking a pipe _____
E. Do you or did you inhale the pipe smoke? Never smoked _____ Not at all _____
   Slightly _____ Moderately _____ Deeply _____

41A. Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for a year) Yes _____ No _____

IF YES TO 41A:
FOR PERSONS WHO HAVE EVER SMOKED CIGARS
B1. How old were you when you started to smoke a cigar regularly? Age _____
2. If you have stopped smoking cigars completely, how old were you when you stopped?
   Age stopped _____  Check if still smoking cigars _____ Does Not Apply _____
C. On the average over the entire time you smoked cigars, how many cigars did you smoke per week?
   Cigars per week _____  Does Not Apply _____
D. How many cigars are you smoking per week now?
   Cigars per week _____  Check if not smoking cigars currently _____
E. Do you or did you inhale the cigar smoke? Never smoked _____ Not at all _____
   Slightly _____ Moderately _____ Deeply _____

Signature _______________________________________ Date ___________________
Mandatory medical questionnaire as modified from the Federal Register/Vol. 51, No. 119/Friday, June 20, 1986/Rules and Regulations. Questions regarding sex, marital status, or race have been removed from the questionnaire.
Division of Public Safety, May 1, 1994
PERIODIC MEDICAL QUESTIONNAIRE
1. NAME ______________________________________________________________
2. SSN _______________________________
4. PRESENT JOB TITLE _________________________________________________
5. DEPARTMENT ______________________________________________________
6 & 7. BUILDING ______________________________________________________
Kansas State University, Manhattan, Kansas 66506
8. PHONE (785) 532- _________________
9. INTERVIEWER ____________________________
10. DATE _________________________________
12. OCCUPATIONAL HISTORY
12A. In the past year did you work full time (30 hours per week or more) for 6 months or more?  Yes _____ No _____
IF YES TO 12A:
12B. In the past year, did you work in a dusty job? Yes _____ No _____
     Does Not Apply _____
12C. Was dust exposure: Mild _____ Moderate _____ Severe _____
12D. In the past year, were you exposed to gas or chemical fumes in your work? Yes _____ No _____
12E. Was exposure: Mild _____ Moderate _____ Severe _____
12F. In the past year, what was your:
     Job/Occupation? _________________________________________
     Position/Job title? _______________________________________
13. RECENT MEDICAL HISTORY
13A. Do you consider yourself to be in good health?   Yes _____ No _____
     If NO, state reason ______________________________________________________
     ___________________________________________________________________
13B. In the past year, have you developed:
     Epilepsy? Yes _____ No _____
     Rheumatic fever? Yes _____ No _____
     Kidney disease? Yes _____ No _____
     Bladder disease? Yes _____ No _____
     Diabetes? Yes _____ No _____
     Jaundice? Yes _____ No _____
     Cancer? Yes _____ No _____
14. CHEST Colds AND CHEST ILLNESSES
14A. If you get a cold, does it usually go to your chest (usually means more than ½ the time?)
     Yes _____ No _____  Don’t get colds _____
15A. During the past year, have you had any chest illnesses that have kept you off work, indoors at home, or in bed? Yes _____ No _____ Does Not Apply _____
IF YES TO 15A:
15B. Did you produce phlegm with any of these chest illnesses?
15C. In the past year, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses _____ No such illnesses _____

16. RESPIRATORY SYSTEM
In the past year have you had (comment further on positive answers):
   a. Asthma        Yes _____ No _____
   b. Bronchitis    Yes _____ No _____
   c. Hay fever     Yes _____ No _____
   d. Other Allergies Yes _____ No _____
   e. Pneumonia     Yes _____ No _____
   f. Tuberculosis  Yes _____ No _____
   g. Chest Surgery Yes _____ No _____
   h. Other Lung Problems Yes _____ No _____
   i. Heart Disease Yes _____ No _____
   j. Frequent Colds Yes _____ No _____
   k. Chronic Cough Yes _____ No _____
   l. Shortness of breath when walking or climbing one flight of stairs Yes _____ No _____
   m. Shortness of breath when walking or climbing one flight of stairs
   n. Wheeze        Yes _____ No _____
   o. Cough up phlegm Yes _____ No _____
   p. Smoke cigarettes Yes _____ No _____
      Packs per day _____ How many years _____

Comment Further on Positive Answers:

Date __________________ Signature

Mandatory medical questionnaire as modified from the Federal Register/Vol. 51, No. 119/Friday, June 20, 1986/Rules and Regulations. Questions regarding sex, marital status, or race have been removed from the questionnaire.
Division of Public Safety, May 1, 1994
(The following is a copy of a memo received.)

July 9, 1998

TO: Vickie DeWitt
FR: Steven J. Galitzer
RE: Vinyl Asbestos Floor Tile and Mastic

After careful consideration, I offer the following in response to your question about what to do about asbestos containing floor mastic. The floor mastic and the vinyl asbestos tiles (VAT) are considered to be non-friable asbestos containing material. They therefore offer no great risk to human life unless they are reduced to a powder. If the VAT is removed and the mastic is left in place, there is even a lesser risk. This is true primarily since the mastic is such a thin layer. If the bare underlayment is to be left and not covered up, then the mastic should be removed. If the underlayment will be covered with another floor, tile, carpet, or some other permanent covering, then there seems to be little reason to remove the non-friable mastic. Even if the floor will be drilled through, with the VAT removed, there is little evidence that the concentration of fibers released to the air will be greater than 0.01 fibers per cubic centimeter. So, to answer your question, I see no reason to remove the mastic in preparation for a new floor. Furthermore, I see little reason to remove the VAT in preparation for carpeting.

cc: M. Warren
CHAPTER 11 – APPENDICES

APPENDIX 10 – POLICY FOR HANDLING ASBESTOS
Appendix 10 Policy for Handling Asbestos

10.1 Introduction

10.1.1 Rules

10.2 Inspection of Buildings for Asbestos

10.2.1 Inspection Required
10.2.2 Inspector Requirements
10.2.3 Pre-Demolition Notification

10.3 Asbestos Containing Materials

10.3.1 Friability
10.3.2 Major Projects
10.3.3 Maintenance Related Work
10.3.4 Certification
10.3.5 Waivers
10.3.6 Nonfriable Asbestos

10.4 Worker Protection

10.4.1 Annual Medical Examination
10.4.2 Responsibility for Payment
10.4.3 Respirators
10.4.4 Protective Clothing

10.5 Asbestos Work Practices for Maintenance Jobs

10.5.1 Allowable Workers
10.5.2 Wall and Floor Covering
10.5.3 Wetting Asbestos Material
10.5.4 Cleanup
10.5.5 Disposal of Asbestos Materials
10.5.6 Visible Asbestos Residue
10.5.7 Cleaning Clothing

10.6 Asbestos Work Practices Using Glove Bags

10.6.1 Glove Bag
10.6.2 Sealing Glove Bags
10.6.3 Wetting Exposed Surfaces
10.6.4 Work Practices

10.7 Asbestos Work for Greater than Maintenance Jobs

10.7.1 Workers Allowed
10.7.2 Ante Rooms
    10.7.2.1 Clean Room
    10.7.2.2 Shower Room
    10.7.2.3 Equipment Room
    10.7.2.4 Plastic Sheeting
10.7.3 HEPA Air Filter
10.7.4 HEPA Vacuum
10.7.5 Covering Surfaces

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10.7.6 Rules
10.7.7 Wetting Asbestos Material
10.7.8 Pigmented Sealant
10.7.9 Cleaning Plastic Sheeting
10.7.10 Cleaning Surfaces
10.7.11 Air Stream
10.7.12 Clearance Sample
  10.7.12.1 Inspection
  10.7.12.2 Training
  10.7.12.3 Sampling Pump
10.7.13 Clearance Sample Requirements
10.7.14 Asbestos Containing Materials

10.8 Work Practices for Nonfriable Asbestos
  10.8.1 Limit Access
  10.8.2 Nonfriable Asbestos Jobs
  10.8.3 Removal of Nonfriable Asbestos
  10.8.4 Training Session

10.9 Disposal of Friable Asbestos Materials
  10.9.1 Plastic Disposal Bags
  10.9.2 Exterior Surface of Disposal Containers
  10.9.3 Transportation to Landfill
  10.9.4 Disposal of Waste Water
  10.9.5 KDHE Approval Needed

10.10 Respirator Protection Program
  10.10.1 Written Standard-Operating Procedure Required
    10.10.1.1 KSU Respiratory Program
    10.10.1.2 Authority – Division of Public Safety
    10.10.1.3 Respirator Use
  10.10.2 Selection and Use of Respirators for Asbestos Work
    10.10.2.1 Respirator Approval
    10.10.2.2 Levels of Respiratory Protection
    10.10.2.3 Requirements
    10.10.2.4 Respiratory Protection Required
      10.10.2.4.1 Pre-removal Activities
      10.10.2.4.2 Removal Activities
      10.10.2.4.3 Clean-up Activities
      10.10.2.4.4 Disposal at Landfill
  10.10.3 Procedures for Wearing Respirators for Asbestos Work
    10.10.3.1 Air-Purifying Respirators
      10.10.3.1.1 Passing Respirator
      10.10.3.1.2 Donning Respirator
      10.10.3.1.3 Pressure Checks
      10.10.3.1.4 Showers
      10.10.3.1.5 Disposal of Filters
      10.10.3.1.6 Visible Contamination
      10.10.3.1.7 Clean Area
    10.10.3.2 Powered-Air Purifying Respirators
      10.10.3.2.1 Clean Respirators
      10.10.3.2.2 Donning the Respirators
      10.10.3.2.3 Fit Test

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10.10.3.2.4 Holding Battery Pack
10.10.3.2.5 Containing Battery Pack
10.10.3.2.6 Shielding Battery Pack
10.10.3.2.7 Shower Procedure
10.10.3.2.8 Disconnecting Battery Pack
10.10.3.2.9 Securing Battery Pack
10.10.3.2.10 Washing Visible Contamination
10.10.3.2.11 Clean Area

10.10.3.3 Airline Respirators
10.10.3.3.1 Proper Respirators
10.10.3.3.2 Donning Respirators
10.10.3.3.3 Connect Airline
10.10.3.3.4 Removing Disposable Clothing
10.10.3.3.5 Showering With Respirator
10.10.3.3.6 Visible Contamination
10.10.3.3.7 Clean Area

10.10.4 Respirator Limitations
10.10.4.1 PAPR's
10.10.4.2 Airline Respirator Use

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Appendix 10  Policy for Handling Asbestos

10.1 Introduction

10.1.1 The U.S. Environmental Protection Agency (EPA), and the Kansas Department of Health and Environment (KDHE) have issued rules and regulations concerning the handling of, or working with, asbestos. Those rules and regulations are summarized below and Kansas State University personnel will comply with the rules.

10.2 Inspection of Buildings for Asbestos

10.2.1 Any building owned by Kansas State University must be properly inspected for the presence of friable and nonfriable asbestos prior to demolition or renovation of the building. Building includes any institutional, commercial, public, industrial, residential or farm structure.

10.2.2 The inspection must be performed by an individual accredited in accordance with the asbestos Model Accreditation Plan (MAP) as stated in the EPA Asbestos School Hazard Abatement Reauthorization Act (ASHARA). The individual designing or conducting asbestos response actions must also be accredited in accordance with the MAP.

10.2.3 National Emission Standards for Hazardous Air Pollutants (NESHAPS) required pre-demolition notification. Ten (10) days prior to demolition of any structure, the EPA must be notified, whether or not asbestos is found in the inspection.

10.3 Asbestos Containing Materials

10.3.1 The potential for an asbestos-containing product to release breathable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure when dry and is therefore likely to emit fibers. The fibrous or fluffy sprayed-on materials used for fireproofing, insulation, or soundproofing are considered to be friable. Materials such as vinyl-asbestos floor tile, roofing felts, or asbestos-cement pipe or sheet (Transite) are considered nonfriable and generally do not emit airborne fibers unless subjected to sanding or sawing operations.

10.3.2 Major (greater than 3 linear or square feet) projects involving the removal and abatement of friable asbestos or materials containing friable asbestos will be handled on a case by case situation. All major asbestos projects shall be coordinated with the Department of Public Safety to ensure compliance with current regulations. The project coordinator must also notify KDHE and the EPA in writing not less than 10 working days before the intended start of the project. Kansas Annotated Regulations (K.A.R.) 28-50-8 provides for waivers in case of an emergency.

10.3.3 Kansas State University personnel certified by the state as asbestos workers may only perform maintenance related work without notification of KDHE. Maintenance related work is any job involving the removal, clean up, or encapsulation of three linear feet or less of friable asbestos from the surface of a pipe or three square feet or less of friable asbestos from any other structure. All maintenance related work shall be coordinated with the Division of Public Safety to ensure compliance with current regulations. All friable asbestos work will be reported in writing to the Division of Public Safety prior to the start of
the job. In the case of emergencies, notification will be by phone immediately followed by a written notification. Please use the Asbestos Maintenance Work form Appendix A (Section 10.12), or a reasonable facsimile.

10.3.4 Each asbestos worker shall be trained in an approved training course in accordance with K.A.R. 28-50-6. Only persons holding a current Kansas Class I or Class II Asbestos Worker certificate may engage in asbestos work in accordance with a K.A.R. 28-50-5. Any Kansas State University department that allows an uncertified individual to engage in asbestos work will be responsible for any fines levied by the EPA, or KDHE, as well as additional costs incurred for air monitoring, surveillance, and asbestos clean up.

10.3.5 Waiver for any individual requirements of these guidelines may be requested from the Division of Public Safety. Waivers will be considered on a case by case determination with approval by KDHE.

10.3.6 Nonfriable asbestos falls outside the state and federal asbestos rules and includes vinyl asbestos floor tile, mastic, transite and any other asbestos material that does not crumble with hand pressure. However, the workers and the public must be adequately protected during all removal procedures.

10.4 Worker Protection

10.4.1 Each asbestos worker shall be examined by a licensed physician within the preceding year and declared by the physician to be physically capable of working while wearing a respirator. The annual medical examination shall include a comprehensive history, a chest X-ray at the discretion of the physician, a pulmonary function test (forced vital capacity ad forced expiratory volume at 1 second) and any other tests the physician requires. A signed statement by the physician shall be submitted to the KDHE at the time of application and a copy shall be maintained by the Division of Public Safety or the employee’s department (K.A.R. 28-50-5-a-1).

10.4.2 The worker’s department will be responsible to pay for the initial and annual medical examination. Physicians of the Lafene Health Center will administer the examination. Workers must use the attached Medical Questionnaire (Appendix B (Section 10.13) for initial exam and Appendix C (Section 10.14) for annual exam).

10.4.3 Respirators shall be worn by all workers while engaged in a maintenance project which disturbs friable asbestos. The respirators must be Mine Safety and Health Administration (MSHA) / National Institute of Occupational Safety and Health (NIOSH) approved for respiratory protection against dust, fumes and mists having an air contamination level less than 0.05 milligrams per cubic meter of air and must include any required attachments and/or filters.

10.4.4 Asbestos workers shall wear appropriate protective clothing to prevent unintentional transfer of asbestos fibers from the work area to other areas including home. Protective clothing shall consist of coveralls, gloves, head covers and foot covers. Protective clothing shall be worn at all times during asbestos work.

10.5 Asbestos Work Practices for Maintenance Jobs

10.5.1 Only certified Kansas Class I or Class II asbestos workers shall be allowed in the work area where asbestos related maintenance work is being performed. An
appropriate danger sign (see Appendix D, Section 10.15) shall be prominently posted at all approaches to the work area until the operation and cleanup is completed (K.A.R. 28-50-1-e).

10.5.2 The walls and floor in the vicinity (not less than six feet from the work site) shall be covered with not less than six-mil thick plastic sheeting. The plastic sheeting shall remain in place until cleanup.

10.5.3 The asbestos material must be wetted with a water solution containing an effective wetting agent prior to being cut, scrapped, removed, or otherwise handled. Power tools are not allowed when working with friable asbestos without prior approval of the Division of Public Safety.

10.5.4 When the job is completed, cleanup shall be done by wet cleaning the surfaces and/or vacuuming with a device equipped with a HEPA filter. This includes all surfaces previously covered by plastic sheeting if there are signs of visible leakage.

10.5.5 All asbestos containing materials that are removed or cleaned from a surface shall be maintained in a wet condition and placed in a sealed container for disposal in accordance with K.A.R. 28-50-14. This includes the plastic sheeting, protective clothing, and respirator cartridges used during the job.

10.5.6 All visible asbestos residue must be cleaned and removed. Any asbestos material left exposed after the job is completed, and surfaces once covered by asbestos shall be covered and sealed with a pigmented sealant before the area can be occupied by persons other than the asbestos workers.

10.5.7 Asbestos workers shall be provided with and shall wear an appropriate respirator and protective clothing while performing the operation. Outer clothing shall be cleaned with a HEPA filter equipped vacuuming device or by wet cleaning methods or removed before the persons move from the plastic sheeting placed on the floor.

10.6 Asbestos Work Practices Using Glove Bags

10.6.1 Each asbestos worker using the glove bag shall avoid damaging other friable asbestos containing materials located in the work area. Damaged sections of pipe or conduit from which the friable asbestos containing material is to be removed that is not immediately enclosed within a glove bag shall be tightly enclosed in six mil thick plastic sheeting until a glove bag is placed over it and the asbestos containing material is removed.

10.6.2 Glove bags shall be sealed to pipe or conduit to provide an airtight seal around the area to be removed.

10.6.3 All exposed surfaces of friable asbestos containing materials shall be wetted as per item 10.5.3 above and maintained in a wet condition until the bag is sealed for final disposal.

10.6.4 All other work practices as outlined in Section 10.5 are to be followed as directed.

10.7 Asbestos Work for Greater than Maintenance Jobs
10.7.1 Only certified Kansas Class I or Class II asbestos workers shall be allowed in the work area where asbestos abatement is being performed. An appropriate danger sign shall be prominently posted at all approaches into the area until the operation and cleanup is completed (K.A.R. 28-50-1-e).

10.7.2 Three ante rooms attaching to the work area.

10.7.2.1 Clean Room – large enough to house all clean, non-contaminated supplies and changing room for personnel.

10.7.2.2 Shower Room – Self-contained shower with hot and cold running water, drain, and adequate soap for washing.

10.7.2.3 Equipment Room – large enough to house all contaminated equipment, clothing waste, and changing room for personnel.

10.7.2.4 These ante rooms must have one layer of 4 mil thick plastic sheeting covering their frames and three layers plastic sheeting acting as entry doors before, between, and after the rooms.

10.7.3 A HEPA air filtering device shall be added to the system to effectively create a negative air pressure in the work area. The exhaust of the HEPA air filtering device shall be vented to outside the building. All air passing to the outside must first pass through a HEPA filter. The HEPA air filtering unit may be placed inside or outside the work area.

10.7.4 All equipment and furniture must be cleaned using wet techniques or a High Efficiency Particulate Air (HEPA) filtered vacuum and removed from the work area, if possible. All surfaces not being abated and non-moveable equipment or furniture must be cleaned using wet techniques or a HEPA vacuum.

10.7.5 All surfaces not on the asbestos abatement schedule in the work site shall be covered with one layer of four mil thick plastic sheeting on the walls and two layers of six mil thick plastic sheeting on the floor. The plastic sheeting shall remain in place until cleanup.

10.7.6 The work area will only be entered and exited via the ante rooms. Respirators must be worn while inside the work area, the equipment room, and the shower room. There will be no eating, drinking, smoking, or using smokeless tobacco once in the ante rooms and the work area.

10.7.7 The asbestos material to be abated must be wetted with a water solution containing an effective wetting agent prior to being cut, scrapped, removed, or otherwise handled.

10.7.8 Any asbestos material left exposed after the job is completed, and surfaces once covered by asbestos shall be covered and sealed with a pigmented sealant.

10.7.9 When the job is completed, the first layer of plastic sheeting must be cleaned by wet cleaning the surfaces and/or HEPA vacuum or completely removed.

10.7.10 After the plastic sheeting has been removed, all previously covered surfaces must be cleaned by wet cleaning or by HEPA
vacuum.

10.7.11 Not less than 24 hours after completing the above step, an air stream from a high speed leaf blower shall be swept across all cleaned surfaces for a minimum of five minutes per 1,000 square feet of area. Fan(s) must be operated in the area during the next 24 hours to maintain air currents in the work space.

10.7.12 After 24 hours, a sample of air must be taken using standard methods for asbestos air monitoring. This sample will be considered the clearance sample.

10.7.12.1 Members of the Division of Public Safety or their designee will enter the work area, inspect the area for asbestos contamination, and take the sample.

10.7.12.2 The individual assigned the task must be adequately trained to inspect the area, take the sample, and must at least be a Class I asbestos worker.

10.7.12.3 Air samples will be collected using a high air flow sampling pump. At least 2,000 liters of air will be sampled for clearance sampling.

10.7.13 The work area will be considered clean only if the clearance sample has a fiber concentration of less than 0.009 fibers/cm$^3$ or none detected (ND). If the clearance sample is greater than 0.009 fibers/cm$^3$, the work area must be re-cleaned or additional air samples taken, whichever the Division of Public Safety deems necessary.

10.7.14 All asbestos-containing materials that are removed or cleaned from a surface shall be maintained in a wet condition and placed in a sealed container for disposal in accordance with K.A.R. 28-50-14. This includes the plastic sheeting used during the job and all contaminated disposable supplies.

10.8 Work Practices for Nonfriable Asbestos

10.8.1 Safe work practices must be followed in any job requiring the handling of nonfriable asbestos. To protect the public, limit access to only essential personnel.

10.8.2 Each nonfriable asbestos job must be handled as a case-by-case situation and must therefore request approval by the Division of Public Safety prior to the start of the job. More stringent worker practices in the situation of ‘about to become friable’ material or more restricted access to the public may be required.

10.8.3 The nonfriable asbestos should be removed using hand operations and completely wetting down the area. The use of mechanical chipping devices to remove nonfriable asbestos materials is not recommended for all situations. Besides wetting down the area, the materials should be constantly misted with water during removal and disposal into waste containers. The waste should be collected and disposed as nonfriable asbestos in the sanitary landfill.
10.8.4 As a minimum, all workers on the project must attend a 90-minute training session on asbestos safety. This must be arranged prior to the start of work.

10.9 Disposal of Friable Asbestos Materials

10.9.1 All friable asbestos materials shall be placed in tightly sealed containers in a wet condition before they are removed from the work area. Waste containers must be double bagged in not less than 6 mil thick plastic bags. Plastic bags may be placed into fiber or metal containers with airtight fitting lids which can be fastened firmly in position.

10.9.2 The exterior surface of each container shall be cleaned free of all visible residue. An asbestos caution label shall be securely attached to each container before its removal from the work area.

10.9.3 The material shall be transported to the landfill under permit number 94-587. This permit is for use by Kansas State University employees only and is not to be used by outside contractors. Asbestos waste must be completely sealed during transportation to the landfill to prevent asbestos fiber loss. The proper Department of Transportation (DOT) labeling and marking must be affixed to each container of asbestos waste.

10.9.4 Waste water from cleanup of asbestos removal projects shall be mixed with the solid waste and disposed with the asbestos. Waste water from decontamination showers and final cleanup of equipment may be disposed of in public sewer systems by discharge into the plumbing system. The wastewater shall be free of any material that is likely to cause stoppage in the plumbing or sewer systems.

10.9.5 Discharge of other waste water not identified in item 10.9.4 above from asbestos related projects must have the approval of KDHE.

10.10 Respirator Protection Program

10.10.1 A written, standard-operating procedure is required by the Worker Protection Regulation, Title 40 Code of Federal Regulations (CFR) 763, subpart G. to provide a document which can be used to administer an effective respiratory protection program, and to provide the information, training, and equipment necessary for proper respiratory protection for asbestos removal.

10.10.1.1 Each Kansas State University department is responsible for the establishment and maintenance of the KSU respiratory program.

10.10.1.2 The Division of Public Safety has overall University responsibility for the program and has authority to make the technical and administrative decisions necessary for the continued success of the program.

10.10.1.3 Each employee shall use only respirators issued or approved by the University in accordance with the training received; the employee shall guard against damage to the respirators and to report any malfunction to their supervisors.

10.10.2 Selection and Use of Respirators for Asbestos Work
10.10.2.1 All available respirators shall be approved by NIOSH for protection against airborne asbestos.

10.10.2.2 The selection of respirators depends upon the airborne concentration of asbestos fibers. The minimum levels of respiratory protection are given below:

<table>
<thead>
<tr>
<th>Respirator Type</th>
<th>Maximum Asbestos Concentration 8-HR TWA *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half-Mask, Air-Purifying</td>
<td>2.0 Fibers/cc</td>
</tr>
<tr>
<td>Full-Face, Air Purifying</td>
<td>2.0 Fibers/cc</td>
</tr>
<tr>
<td>Powered-Air Purifying or continuous flow airline</td>
<td>20.0 Fibers/cc</td>
</tr>
<tr>
<td>Full-face Pressure on Demand Airline</td>
<td>200.0 Fibers/cc</td>
</tr>
<tr>
<td>Full-face Continuous-flow, supplied air equipped with auxiliary Self Contained Breathing Apparatus (SCBA)</td>
<td>Greater than 200.0 Fibers/cc or unknown concentration</td>
</tr>
</tbody>
</table>

* Respiration protection factor using a Qualitative Fit Test based on a Time Weighted Average (TWA)

10.10.2.3 Respirators meeting the above minimum protection requirements are required. Respirators with higher levels of protection may be used.

10.10.2.4 Adequate respiratory protection shall be worn during all asbestos related jobs including:

10.10.2.4.1 all pre-removal activities when the possibility of exposure to airborne asbestos fibers exists;

10.10.2.4.2 all removal activities;

10.10.2.4.3 all clean-up, decontamination, and disposal activities, until the final clearance level has been met;

10.10.2.4.4 disposal at the landfill to avoid exposure if the potential for an asbestos container rupture exists.

10.10.3 Procedures for Wearing Respirators for Asbestos Work.

10.10.3.1 Air-Purifying Respirators.

10.10.3.1.1 Only a clean, sanitized, and inspected respirator shall be worn.

10.10.3.1.2 The respirator shall be properly donned in the...
Clean Area, prior to putting on disposable hoods or any other articles worn on the head or neck.

10.10.3.1.3 Prior to leaving the Clean Area, a positive and negative pressure check shall be performed. If successful, any remaining clothing and equipment can be donned, and the worker can proceed to the duties. If not successful, the worker will contact the job supervisor. A qualitative fit test may be required at any time.

10.10.3.1.4 Each time the worker exits the work area, the respirator is worn into the shower, and the respirator is thoroughly soaked before it is removed.

10.10.3.1.5 The respirator is then removed and the filters placed in the labeled receptacle.

10.10.3.1.6 Any visible contamination is washed from the respirator, and the respirator is placed in the labeled receptacle.

10.10.3.1.7 After removing the respirator, the worker showers and proceeds to the Clean Area.

10.10.3.2 Powered-Air Purifying Respirators

10.10.3.2.1 Only a clean and inspected respirator shall be worn. If shared use, the respirator shall also be sanitized before being worn.

10.10.3.2.2 The respirator shall be properly donned in the Clean Area, prior to putting on disposable hoods or any other articles worn on the head or neck.

10.10.3.2.3 Prior to leaving the Clean Area, a fit test shall be performed. If successful, any remaining clothing and equipment can be donned, and the worker can proceed to the duties. If not successful, the worker will check the respirator, re-don the device, and again perform a negative or positive pressure check. If successful, the worker will don any remaining clothing and equipment and proceed with the duties. If the check is still unsuccessful, an alternative respirator should be worn.

10.10.3.2.4 Each time the worker exits the work area, the battery pack is carefully held while the worker removes disposable clothing in the Equipment Room.

10.10.3.2.5 The worker then shuts off the battery pack and places it into the designated plastic bag. The battery pack is still connected to the respirator. Clean air is still...
being supplied to the worker, but the respirator is now a negative-pressure device.

10.10.3.2.6 The worker proceeds into the shower and carefully holds closed the plastic bag at the point where the breathing tube connects to the battery pack.

10.10.3.2.7 The worker then soaks the respirator and exposed breathing tube.

10.10.3.2.8 After the exposed respirator parts are soaked, the respirator is removed, and the breathing tube is carefully disconnected from the battery pack, while holding the top shut.

10.10.3.2.9 The battery pack is secured with the closure provided and placed in the labeled receptacle.

10.10.3.2.10 Any visible contamination is washed from the respirator, and the respirator is then placed in the labeled receptacle.

10.10.3.2.11 After removing the respirator, the worker showers and proceeds to the Clean Area.

10.10.3.3 Airline Respirators

10.10.3.3.1 Only a clean, sanitized and inspected respirator shall be worn.

10.10.3.3.2 The respirator shall be properly donned in the Clean Area, prior to putting on disposable hoods or any other articles worn on the head or neck.

10.10.3.3.3 Prior to leaving the Clean Area, the airline will be connected to the respirator.

10.10.3.3.4 Each time the worker exits the work area, the respirator remains on while the worker removes disposable clothing in the Equipment Room.

10.10.3.3.5 The respirator is worn into the shower, and thoroughly soaked before it is removed.

10.10.3.3.6 All visible contamination is washed from the device, the airline is disconnected, and the respirator is placed in the labeled receptacle.

10.10.3.3.7 After removing the respirator, the worker showers and proceeds to the Clean Area.

10.10.4 Respirator Limitations

10.10.4.1 Air-purifying respirators and Powered-Air Purifying
Respirators (PAPR) are to be used only in atmospheres that are not oxygen-deficient, atmospheres that are not Immediately Dangerous to Life or Health (IDLH), and atmospheres that do not exceed the protection factors listed in paragraph 10.10.2.2 above.

10.10.4.2 Airline respirators are to be used only in atmospheres that are not IDLH.

10.10.5 Donning Air-Purifying Respirators:

10.10.5.1 Check to ensure that all required parts are present and intact.

10.10.5.2 Check to ensure that the device is clean.

10.10.5.3 Place the device over the face by first fitting the chin into the respirator and pulling the facepiece to the face.

10.10.5.4 Position the headbands around the crown of the head and the back of the neck.

10.10.5.5 Adjust the headbands, beginning with the lowest ones, until a tight, but comfortable fit is obtained.

10.10.5.6 Perform a negative or positive pressure check. Each time a respirator is donned, a negative or positive pressure check is done by the wearer:

10.10.5.6.1 Negative check – Place the palms of the hands over each filter to seal off the inhalation valves. Inhale slightly to create a negative pressure inside the facepiece. If no air escapes, proceed with the job duties. If air escapes, readjust the respirator and check again.

10.10.5.6.2 Positive check – Place the palm of the hand or the thumb over the exhalation valve cover and press lightly. Exhale slightly to create a positive pressure inside the facepiece. If no air escapes, proceed with the job duties. If air escapes, readjust the respirator and check again.

10.10.6 Donning Powered-Air Purifying Respirators:

10.10.6.1 Check to ensure that all required parts are present and intact.

10.10.6.2 Check to ensure that the device is clean.

10.10.6.3 Place the device over the face by first fitting the chin into the respirator and pulling the facepiece to the face.

10.10.6.4 Position the headbands around the crown of the head and the back of the neck.

10.10.6.5 Adjust the headbands, beginning with the lowest ones,
until a tight, but comfortable fit is obtained.

10.10.6.6 Perform a fit test. Each time respirator is donned a fit test is done by the wearer. The palm of the hand is placed over the end of the breathing tube, and the wearer inhales slightly, creating negative pressure inside the facepiece. If no air escapes, proceed with the job duties. If air escapes, readjust the respirator and check again.

10.10.6.7 The breathing tube is then connected to a fully-charged battery pack, and the back is fastened to the small of the back.

10.10.7 Donning Airline Respirators:

10.10.7.1 The hood is placed over the head.

10.10.7.2 The airline is connected prior to leaving the Clean Area.

10.10.8 Donning Helmet Type Respirators:

10.10.8.1 Check to ensure all required parts are present and intact.

10.10.8.2 Check to ensure the device is clean.

10.10.8.3 Fit the filter unit and/or power pack around the waist.

10.10.8.4 After adjusting the helmet to fit snugly on the head, the helmet is placed on the head and the chin strap tightened under the chin.

10.10.8.5 The face shield is snapped down into position, with the chin protector fitting under the chin and covering any facial hair.

10.10.8.6 The power is turned on prior to leaving the clean area.

10.10.9 Respirator Fit Testing

10.10.9.1 Qualitative fit testing is conducted for air-purifying respirators.

10.10.9.2 The procedure is done prior to issuing a worker with a respirator and every six months.

10.10.9.3 Test procedure.

10.10.9.3.1 The worker dons the respirator (equipped with HEPA and/or acid/gas filters) and must successfully pass a negative or positive pressure check before proceeding.

10.10.9.3.2 The worker is allowed to wear the respirator for at least 10 minutes before beginning the test.

10.10.9.3.3 The test procedure is reviewed with the worker.
10.10.9.3.4 Both ends of the ventilation smoke tube (stannic oxychloride) are broken.

10.10.9.3.5 A short length of tubing is attached to one end of the tube, and the other end is attached to a low flow pump set to deliver 200 cc/minute or some other air pumping device.

10.10.9.3.6 Instruct the subject to keep his or her eyes closed during the test, and the test is conducted within an enclosure.

10.10.9.3.7 Direct the stream of smoke toward the face-to-facepiece seal, beginning 12 inches away and gradually moving to within one inch of the respirator.

10.10.9.3.8 Perform the following exercises while the deal is being tested. Each exercise is performed for one minute:

   (1). Normal breathing.
   (2). Deep breathing (deep and regular).
   (3). Turning head from side-to-side, while inhaling.
   (4). Nodding head up-and-down, while inhaling.
   (5). Talking. Talk aloud and slowly for several minutes or counting to 100.
   (6). Jogging in place.
   (7). Normal breathing.

10.10.9.3.9 If the irritant smoke produces an involuntary cough, stop the test. In this case, the respirator is either rejected, readjusted and retested, or another respirator is selected and tested.

10.10.9.3.10 Each person who passes the test is given a sensitivity check of the smoke from the same tube to determine if he or she reacts to the smoke. Failure to evoke a response voids the fit test.

10.10.10 Respirator Cleaning, Maintenance and Storage Procedures.

10.10.10.1 Cleaning:

   10.10.10.1.1 Labeled receptacles, which contain the manufacturer’s recommended cleaning solution, are maintained in the shower.

   10.10.10.1.2 The facepieces are removed from the receptacles and are disassembled.
10.10.10.3  All parts are washed in warm soapy water, and visible residue is removed with a brush.

10.10.10.4  The parts are rinsed in clean water and allowed to air-dry.

10.10.10.2  Inspection:

10.10.10.2.1  All parts are inspected for dirt, residue, pliability of rubber, deterioration and cracks, tears, and holes.

10.10.10.2.2  The valves are checked for holes, warpage, cracks, and dirt.

10.10.10.2.3  Check hoods, helmets, and faceshields for cracks, tears, abrasions, and distortions.

10.10.10.2.4  Check air supply for air quality, breaks or kinks in the supply hoses and detachable coupling attachments, tightness of connectors, and manufacturer’s recommendations concerning the proper setting of regulators and valves.

10.10.10.2.5  Check that couplings are compatible with other couplings used on the site.

10.10.10.2.6  Check the air purifying elements, carbon monoxide alarm, and high temperature shut-off.

10.10.10.3  Storage:

10.10.10.3.1  All cleaned and inspected respirators are stored in plastic bags in the Clean Area.

10.10.10.3.2  The devices are stored in a normal position.

10.10.10.4  Special Procedures for Airline Respirators

10.10.10.4.1  Air pumps are routinely used for airline respirators. The intake must be located in a clean, temperature controlled air source.

10.10.10.4.2  Compressed breathing air is tested weekly with a Draeger Aerotest Kit or compatible air test to insure that the following air purity standards are met:

(1).  Oxygen = 19-23%

(2).  Carbon Monoxide = 20 ppm

(3).  Hydrocarbon = 5 mg/m3

(4).  Carbon Dioxide = 1,000 ppm
10.10.4.3 The individual performing the tests will be technically competent.

10.10.4.4 The test results are recorded in the Test Log.

10.11 Respirator Training

10.11.1 Supervisor Training: Each year, supervisors must be trained in:

10.11.1.1 Basic respiratory protection practices;

10.11.1.2 Selection and use of respirators for protection from airborne asbestos fibers;

10.11.1.3 The nature and extent of the hazards to which workers are exposed;

10.11.1.4 The structure and operation of the entire respiratory protection program; and

10.11.1.5 The legal requirements pertinent to the use of the respirators.

10.11.2 Employee Training: Each year, workers must be trained in:

10.11.2.1 The nature and extent of the inhalation hazards of chemicals, mists, and dusts including asbestos;

10.11.2.2 An accurate account of what may happen if the proper device is not worn correctly;

10.11.2.3 An explanation of why respirators are necessary;

10.11.2.4 A discussion of why these devices are the proper types for the job;

10.11.2.5 A discussion of the capabilities and limitations of the respirators;

10.11.2.6 Instruction and training in actual use and frequent supervision to assure that the devices continue to be used properly;

10.11.2.7 An opportunity to: handle the respirator, have the respirator properly fitted, test the face-facepiece seal, wear the device in normal air for a long familiarity period, and wear the respirator in a test atmosphere.
10.11 References


KANSAS STATE UNIVERSITY
ASBESTOS MAINTENANCE WORK REPORT

DATE ______________________

PROJECT DATE _____________________________     TIME __________________

PROJECT DESCRIPTION:
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

BUILDING AND ROOM
______________________________________________________________________

EMERGENCY PROJECT YES _______ NO _______

WORKER’S NAME:
______________________________________________________________________

SUPERVISOR’S NAME:
______________________________________________________________________

REMARKS:

Public Safety, April 1, 1990
INITIAL MEDICAL QUESTIONNAIRE

1. NAME _____________________________________________________________
2. SSN _______________________________________________________________
3. PRESENT JOB TITLE ________________________________________________
4. DEPARTMENT _____________________________________________________
5. 6 & 7. BUILDING __________________________________________________
(Kansas State University, Manhattan, Kansas 66506)
8. PHONE (785) 532-____________________________________________________
9. INTERVIEWER _____________________________________________________
10. DATE ____________________________________________________
11. Date Of Birth (Month, Day, Year) ___________________________________
12. Place of Birth ____________________________________________________

OCCUPATIONAL HISTORY:
17A. Have you ever worked full time (30 hours per week or more) for 6 months or more?
   Yes _______ No _______

IF YES TO 17A:
17B. Have you ever worked for a year or more in any dusty job?
   Yes _______ No _______ Does not apply _______
   Specify job/industry ________________________________________________
   Total Years Worked _______
   Was dust exposure: Mild _______ Moderate _______ Severe _______

17C. Have you ever been exposed to gas or chemical fumes in your work?
   Yes _______ No _______
   Specify job/industry ________________________________________________
   Total Years Worked _______
   Was exposure: Mild _______ Moderate _______ Severe _______

17D. What has been your usual occupation or job – the one you have worked at the
   longest?
   1. Job/occupation ________________________________________________
   2. Number of years employed in this occupation ______________________
   3. Position/job title ______________________________________________
   4. Business, field or industry ______________________________________

   (Record on lines the years you have worked in any of these industries, e.g. 1960-1969)

17 E-J. Have you ever worked:
   E. In a mine? Yes _______ No _______
   F. In a quarry? Yes _______ No _______
   G. In a foundry? Yes _______ No _______
   H. In a pottery? Yes _______ No _______
   I. In a cotton, flax or hemp mill? Yes _______ No _______
   J. With asbestos? Yes _______ No _______

18. PAST MEDICAL HISTORY
18A. Do you consider yourself to be in good health? Yes _______ No _______
   If “NO” state reason ______________________________________________

18B. Have you any defect of vision? Yes _______ No _______

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If ‘YES’ state nature of defect ________________________________________

18C. Have you any hearing defect? Yes _____ No _____
If ‘YES’ state nature of defect ________________________________________

18D. Are you suffering from or have you ever suffered from:
   a. Epilepsy (or fits, seizures, convulsions)? Yes _____ No _____
   b. Rheumatic fever? Yes _____ No _____
   c. Kidney disease? Yes _____ No _____
   d. Bladder disease? Yes _____ No _____
   e. Diabetes? Yes _____ No _____
   f. Jaundice? Yes _____ No _____

19. CHEST COLDS AND CHEST ILLNESSES

19A. If you get a cold, does it usually go to your chest? (Usually means more than ½ the
time) Yes _____ No _____ Don’t get colds _____

20A. During the past 3 years, have you had any illnesses that have kept you off work,
indoors at home, or in bed? Yes _____ No _____

IF YES TO 20A:

20B. Did you produce phlegm with any of these chest illnesses?
   Yes _____ No _____ Does Not Apply _____

20C. In the last 3 years, how many such illnesses with (increased) phlegm did you have
which lasted a week or more? Number of illnesses _______
No such illness _______

21. Did you have any lung trouble before the age of 16? Yes _____ No _____

22. Have you ever had any of the following?
   1A. Attacks of bronchitis? Yes _____ No _____
      IF YES TO 1A:
      B. Was it confirmed by a doctor? Yes _____ No _____
      C. At what age was your first attack?
         Age in Years _______ Does Not Apply _____

   2A. Pneumonia? (include bronchopneumonia)? Yes _____ No _____
      IF YES TO 2A:
      B. Was it confirmed by a doctor? Yes _____ No _____
         Does Not Apply _____
      C. At what age did you first have it? Age in Years _______
         Does Not Apply _____

   3A. Hay Fever? Yes _____ No _____
      IF YES TO 3A:
      B. Was it confirmed by a doctor? Yes _____ No _____
         Does Not Apply _____
      C. At what age did it start? Age in Years _______
         Does Not Apply _____

   23A. Have you ever had chronic bronchitis? Yes _____ No _____
      IF YES TO 23A:
      B. Do you still have it? Yes _____ No _____ Does Not Apply _____
      C. Was it confirmed by a doctor? Yes _____ No _____
         Does Not Apply _____
      D. At what age did it start? Age in Years _______
         Does Not Apply _____

24A. Have you ever had emphysema? Yes _____ No _____
IF YES TO 24A:
   B. Do you still have it?   Yes _______   No _______   Does Not Apply_______
   C. Was it confirmed by a doctor?   Yes _______ No _______
      Does Not Apply _______
   D. At what age did it start?   Age in Years _______   Does Not Apply _______

25A. Have you ever had asthma?   Yes _______   No _______

IF YES TO 25A:
   B. Do you still have it?   Yes _______   No _______  Does Not Apply _______
   C. Was it confirmed by a doctor? Yes _______   No _______
      Does Not Apply _______
   D. At what age did it start?  Age in Years _______   Does Not Apply _______
   E. If you no longer have it, at what age did it stop?
      Age stopped _______  Does Not Apply _______

26. Have you ever had:
   A. Any other chest illness? Yes _______   No _______
      If yes, please specify _______________________________________________
   B. Any chest operations?   Yes _______   No _______
      If yes, please specify _______________________________________________

27A. Has a doctor ever told you that you had heart trouble?   Yes _______   No _______

IF YES TO 27A:
   B. Have you ever had treatment for heart trouble in the past 10 years?
      Yes _______   No _______

28A. Has a doctor ever told you that you had high blood pressure?  Yes _______
      No _______

IF YES TO 28A:
   B. Have you had any treatment for high blood pressure (hypertension) in the past 10 years?
      Yes _______   No _______   Does Not Apply _______

29. When did you last have your chest X-rayed? (year) _________________________

30  Where did you last have your chest X-rayed? (if known) ___________________
What was the outcome? ___________________________________________________

FAMILY HISTORY
31. Were either of your natural parents ever told by a doctor that they had a chronic lung condition such as (circle correct answer):
   A. Chronic Bronchitis?  Yes ____ No ____ Don’t Know ____ (Father or Mother)
   B. Emphysema? Yes ____ No ____ Don’t Know ____ (Father or Mother)
   C. Asthma? Yes ____ No ____ Don’t Know ____ (Father or Mother)
   D. Lung Cancer? Yes ____ No ____ Don’t Know ____ (Father or Mother)
   E. Other Chest Conditions? Yes ____ No ____ Don’t Know ____ (Father or Mother)
   F. Is parent currently alive? Yes ____ No ____ Don’t Know ____ (Father or Mother)
   G. Please specify:
      Father, age if living _____ Age at death _______  Don’t know _______
      Mother, age if living _____ Age at death _______  Don’t know _______

H. Please specify cause of death
______________________________________________________________

COUGH
32A. Do you usually have a cough? (Count a cough with first smoke or on first going out of doors. Exclude clearing of throat.) [If no, skip to question 32C.].
   Yes _____ No _____
B. Do you usually cough as much as 4 to 6 times a day 4 or more days out of the week?
   Yes _____ No _____
C. Do you usually cough at all on getting up or first thing in the morning?
   Yes _____ No _____
D. Do you usually cough at all during the rest of the day or at night?
   Yes _____ No _____

IF YES TO ANY OF ABOVE (32A, B, C, OR D) ANSWER THE FOLLOWING. IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.
E. Do you usually cough like this on most days for 3 consecutive months or more during the year? Yes _____ No _____ Does Not Apply _____
F. For how many years have you had the cough?
   Number of Years _____ Does Not Apply _____

33A. Do you usually bring up phlegm from you chest? (Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm.)
   Yes _____ No _____ Does Not Apply _____
(IF NO SKIP TO 33C)
B. Do you usually bring up phlegm like this as much as twice a day 4 or more days out of the week?
   Yes _____ No _____ Does Not Apply _____
C. Do you usually bring up phlegm at all on getting up or first thing in the morning?
   Yes _____ No _____ Does Not Apply _____
D. Do you usually bring up phlegm at all during the rest of the day or at night?
   Yes _____ No _____ Does Not Apply _____

IF YES TO ANY OF THE ABOVE (33A, B, D, OR D), ANSWER THE FOLLOWING; IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.
E. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? Yes _____ No _____ Does Not Apply _____
F. For how many years have you had trouble with phlegm?
   Number of years _____ Does Not Apply _____

EPISODES OF COUGH AND PHLEGM
34A. Have you had periods or episodes of (increased*) cough and phlegm lasting for 3 weeks or more each year? Yes _____ No _____
   * (For persons who usually have cough and/or phlegm)

IF YES TO 34A
B. For how long have you had at least 1 such episode per year?
   Number of Years _____ Does Not Apply _____

WHEEZING
35A. Does your chest ever sound wheezy or whistling?
   1. When you have a cold? Yes _____ No _____
   2. Occasionally apart from colds? Yes _____ No _____
   3. Most days or nights? Yes _____ No _____

IF YES TO 1, 2, OR 3 IN 35A
B. For how many years has this been present?
   Number of Years _____ Does Not Apply _____

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36A. Have you ever had an attack of wheezing that has made you feel short of breath?
   Yes _____ No _____

IF YES TO 36A
B. How old were you when you had your first such attack?
   Age in Years _____ Does Not Apply _____
C. Have you had 2 or more such episodes?  Yes _____ No _____
   Does Not Apply _____
D. Have you ever required medicine or treatment for the(se) attack(s)?
   Yes _____ No _____ Does Not Apply _____

BREATHELESSNESS
37. If disabled from walking by any condition other than heart or lung disease, please describe and proceed to question 39A.
   Nature of condition(s) _____________________________________________________
   ________________________________________________________________________

38A. Are you troubled by shortness of breath when hurrying on the level or walking up a short hill?
   Yes _____ No _____

B. Do you have to walk slower than people at your age on the level because of breathlessness?  Yes _____ No _____ Does Not Apply _____

C. Do you ever have to stop for breath when walking at your own pace on the level?
   Yes _____ No _____ Does Not Apply _____

D. Do you ever have to stop for breath when walking at your own pace on the level?
   Yes _____ No _____ Does Not Apply _____

E. Are you too breathless to leave the house or breathless on dressing or climbing one flight of stairs?  Yes _____ No _____ Does Not Apply _____

TOBACCO SMOKING
39A. Have you ever smoked cigarettes?  (No means less than 20 packs of cigarettes or 12 oz. of tobacco in a lifetime or less than 1 cigarette a day for a year.)
   Yes _____ No _____

IF YES TO 39A
B. Do you now smoke cigarettes (as of one month ago)?
   Yes _____ No _____ Does Not Apply _____

C. How old were you when you first started regular cigarette smoking?
   Yes _____ No _____ Does Not Apply _____

D. If you have stopped smoking cigarettes completely, how old were you when you stopped?  Age stopped _____ Check if still smoking _____
   Does Not Apply _____

E. How many cigarettes do you smoke per day now?
   Cigarettes per day _____ Does Not Apply _____

F. On the average of the entire time you smoked, how many cigarettes did you smoke per day?
   Cigarettes per day _____ Does Not Apply _____

G. Do or did you inhale the cigarette smoke?  Does Not Apply _____
Not at all _____ Slightly _____ Moderately _____ Deeply _____

40A. Have you ever smoked a pipe regularly? (Yes means more than 12 oz. of tobacco in a lifetime.)   Yes _____ No _____

IF YES TO 40A:
FOR PERSONS WHO HAVE EVER SMOKED A PIPE
B1. How old were you when you started to smoke a pipe regularly?   Age _____
2. If you have stopped smoking a pipe completely, how old were you when you stopped?
   Age stopped _____   Check if still smoking pipe _____ Does Not Apply _____

C. On the average over the entire time you smoked a pipe, how much pipe tobacco did you smoke per week?   _____ oz. per week (a standard pouch of tobacco contains 1 ½ oz.)

D. How much pipe tobacco are you smoking now?   _____ oz. per week
   Not currently smoking a pipe _____

E. Do you or did you inhale the pipe smoke?   Never smoked _____ Not at all _____
   Slightly _____ Moderately _____ Deeply _____

41A. Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for a year)   Yes _____ No _____

IF YES TO 41A:
FOR PERSONS WHO HAVE EVER SMOKED CIGARS
B1. How old were you when you started to smoke a cigar regularly?   Age _____
2. If you have stopped smoking cigars completely, how old were you when you stopped?
   Age stopped _____   Check if still smoking cigars _____ Does Not Apply _____

C. On the average over the entire time you smoked cigars, how many cigars did you smoke per week?
   Cigars per week _____ Does Not Apply _____

D. How many cigars are you smoking per week now?
   Cigars per week _____ Check if not smoking cigars currently _____

E. Do you or did you inhale the cigar smoke?   Never smoked _____ Not at all _____
   Slightly _____ Moderately _____ Deeply _____

Signature ______________________________________ Date ___________________

Mandatory medical questionnaire as modified from the Federal Register/Vol. 51, No. 119/Friday, June 20, 1986/Rules and Regulations. Questions regarding sex, marital status, or race have been removed from the questionnaire.
Division of Public Safety, May 1, 1994
PERIODIC MEDICAL QUESTIONNAIRE
1. NAME ______________________________________________________________
2. SSN ______________________________________________________________
4. PRESENT JOB TITLE _________________________________________________
5. DEPARTMENT ______________________________________________________
6 & 7. BUILDING ______________________________________________________
Kansas State University, Manhattan, Kansas 66506
8. PHONE (785) 532- _________________
9. INTERVIEWER ________________________________________
10. DATE _____________________________________
12. OCCUPATIONAL HISTORY
12A. In the past year did you work full time (30 hours per week or more) for 6 months or more?   Yes _____ No _____
   IF YES TO 12A:
12B. In the past year, did you work in a dusty job?  Yes _____ No _____
       Does Not Apply _____
12C. Was dust exposure:  Mild _____ Moderate _____ Severe _____
12D. In the past year, were you exposed to gas or chemical fumes in your work?  
       Yes _____ No _____
12E. Was exposure:  Mild _____ Moderate _____ Severe _____
12F. In the past year, what was your:
       Job/Occupation? ________________________________________
       Position/Job title? _______________________________________
13. RECENT MEDICAL HISTORY
13A. Do you consider yourself to be in good health?   Yes _____ No _____
       If NO, state reason ______________________________________________________
       ____________________________________________________________________
13B. In the past year, have you developed:
       Epilepsy?  Yes _____ No _____
       Rheumatic fever? Yes _____ No _____
       Kidney disease?  Yes _____ No _____
       Bladder disease?  Yes _____ No _____
       Diabetes?  Yes _____ No _____
       Jaundice?  Yes _____ No _____
       Cancer?  Yes _____ No _____
14. CHEST COLDS AND CHEST ILLNESSES
14A. If you get a cold, does it usually go to your chest (usually means more than ½ the time?)
       Yes _____ No _____ Don’t get colds _____
15A. During the past year, have you had any chest illnesses that have kept you off work, indoors at home, or in bed?  Yes _____ No _____ Does Not Apply _____
   IF YES TO 15A:
15B. Did you produce phlegm with any of these chest illnesses?
15C. In the past year, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses _____  No such illnesses _____

16. RESPIRATORY SYSTEM
In the past year have you had (comment further on positive answers):
   a. Asthma    Yes _____  No _____
   b. Bronchitis Yes _____  No _____
   c. Hay fever  Yes _____  No _____
   d. Other Allergies Yes _____  No _____
   e. Pneumonia  Yes _____  No _____
   f. Tuberculosis Yes _____  No _____
   g. Chest Surgery Yes _____  No _____
   h. Other Lung Problems Yes _____  No _____
   i. Heart Disease Yes _____  No _____
Do you have (comment further on positive answers):
   k. Frequent Colds Yes _____  No _____
   l. Chronic Cough Yes _____  No _____
   m. Shortness of breath when walking or climbing one flight of stairs Yes _____  No _____
Do you (comment further on positive answers):
   n. Wheeze    Yes _____  No _____
   o. Cough up phlegm Yes _____  No _____
   p. Smoke cigarettes Yes _____  No _____
       Packs per day _____  How many years _____
Comment Further on Positive Answers:

Date ________________ Signature ______________________________________

Mandatory medical questionnaire as modified from the Federal Register/Vol. 51, No. 119/Friday, June 20, 1986/Rules and Regulations. Questions regarding sex, marital status, or race have been removed from the questionnaire.
Division of Public Safety, May 1, 1994
TO: Vickie DeWitt  
FR: Steven J. Galitzer  
RE: Vinyl Asbestos Floor Tile and Mastic  

After careful consideration, I offer the following in response to your question about what to do about asbestos containing floor mastic. The floor mastic and the vinyl asbestos tiles (VAT) are considered to be non-friable asbestos containing material. They therefore offer no great risk to human life unless they are reduced to a powder. If the VAT is removed and the mastic is left in place, there is even a lesser risk. This is true primarily since the mastic is such a thin layer. If the bare underlayment is to be left and not covered up, then the mastic should be removed. If the underlayment will be covered with another floor, tile, carpet, or some other permanent covering, then there seems to be little reason to remove the non-friable mastic. Even if the floor will be drilled through, with the VAT removed, there is little evidence that the concentration of fibers released to the air will be greater than 0.01 fibers per cubic centimeter.  

So, to answer your question, I see no reason to remove the mastic in preparation for a new floor. Furthermore, I see little reason to remove the VAT in preparation for carpeting.

cc: M. Warren
CHAPTER 11 – APPENDICES

APPENDIX 12 – PARKING REGULATIONS
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Appendix 12 Parking Regulations

KANSAS STATE UNIVERSITY
MANHATTAN, KANSAS
1999-2000

REGULATIONS GOVERNING TRAFFIC AND PARKING ON THE ROADS, STREETS, DRIVEWAYS AND PARKING FACILITIES

PARKING MISSION STATEMENT – To provide reliable and informative customer service in a courteous and timely manner, while providing as positive a parking experience as possible given the limitations of space, finances, rules and regulations under which we are required to operate.

INTRODUCTION
By the authority vested in the Kansas Board of Regents through the provisions of Kansas Statute 74-3209—74-3216, regulations pertaining to the operation and parking of vehicles are hereby established and set forth. Students, faculty, and staff are expected to be familiar with and abide by these regulations. The vehicle operator is responsible for knowing all applicable laws and regulations. The Kansas State University parking system receives no funding from the State of Kansas; therefore, parking permit fees and misuse fees will be deposited in the Parking Fee Fund and may be used for payment of the expense of enforcing these rules and regulations and for the construction, acquisition, maintenance and repair of parking facilities at Kansas State University.

OFFICES:

KSU PARKING SERVICES INFORMATION BOOTH KSU POLICE DEPARTMENT
108 EDWARDS HALL 17TH STREET & K-STATE UNION 108 EDWARDS HALL
HOURS: 7:30 AM-5:30 PM HOURS: 7:30 AM-4:30 PM 24 HRS. 7 DAYS A WEEK
MONDAY THRU FRIDAY MONDAY THRU FRIDAY (785) 532-6412
(785) 532-PARK (7275) (785) 532-6452

Definition of Parking – the standing of a vehicle, whether occupied or not.

CONTENTS:

1. Appeals-Sec: V.D
2. Bicycle/Skateboards-Sec: IV
3. Clients-Sec: V.A.4
4. Conference Permits-Sec: II.F.3
5. Driving Regulations-Sec: III
6. Enforcement-Sec: V.A
7. Excessive Violator-Sec: V.C.4
8. Faculty/Staff-Sec: II.D
9. General-Sec: I.A
10. Impounding-Sec: V.A.3
11. KSU Salina Permits-Sec:II.E
12. Lost/Stolen-Sec: II.G.3
13. Misuse Fees-Sec: V.B
14. Motorcycle Parking-Sec: I.6
15. Other Penalties-Sec: V.C
16. Parking Areas-Sec: I.A.2
17. Permit Fee Schedule-Sec: II.B
18. Permit Types-Sec: II.B
19. Physically Disabled-Sec: II.F.1
20. Refunds-Sec: II.B
21. Reserved Stalls-Sec: II.F.4
22. Service Stalls/Permit-Sec: II.F.5
23. Shuttle-Sec: II.F.7.c
24. Special Permits-Sec: II.F
25. Storage-Sec: I.A.11
26. Student-Sec: II.C
27. Vendor/Contractor-Sec: II.F.6
28. Visitor/Frequent-Sec: II.F.2.e

I: GENERAL

A. REQUIREMENTS
1. All motor vehicles, including MOPEDS (See #6 below), parked on University property must be
identified with a properly displayed University parking permit at the following scheduled times;
a. Faculty/Staff and Commuting Student lots 7am-5pm Monday through Friday
b. Residence Hall & Jardine lots 24 hours, 7 days a week.
c. Recreation Complex 7am-4pm Monday through Friday.
d. All restricted lots/disabled/reserved/loading/timed stalls 24 hours, 7 days a week unless
otherwise stated on sign.
2. Parking is permitted only in designated areas (See #3 below for exception). Posted signs will
designate the type of permit required to park in each lot, area and/or restricted location.
O Lots - Designated for Commuting Students lots.
W Lots - Designated for Faculty/Staff lots.
T Lots - Designated for Faculty/Staff and Commuting Students lots.
R Lots - Designated for Residence Halls lots.
CP Lots - Designated for Recreation Center Parking only with a time limit not to exceed 2
hours. All current KSU Parking Permits are valid in this lot; however, all are subject
to the 2 hour parking limit.
J Lots - Designated for Jardine Terrace lots.
K Lots - Designated for Government/State Vehicles lots.
Z Lots - Designated any valid KSU permit except CP permits.
Y Lots - Designated as Restricted (See posted sign for type of permit or designator needed)
lots.
A permit does not guarantee a parking space at any particular time. Permits, applications,
and related information may be obtained at KSU Parking Services.
3. When school is in session during the regular fall and spring semesters: faculty, staff and
students may park only in the type of lot specified by their permits (during hours permits are
required).
4. Parking permits are not required on University holidays (University closed). All other
regulations will be enforced.
5. Parking permits are not required for cars parked in metered parking stalls. Maximum time limits
and enforcement hours are designated on the meter. All meter malfunctions must be reported
to KSU Parking Services within 2 hours of receiving citation. Citation may be excused only if
malfunction is verified by Parking Services.
6. Motorized bicycles, motorbikes, scooters, and MOPEDS (50cc and less) may utilize either
bicycle, with bicycle permit, or motorcycle, with motorcycle permit, parking. Motorcycles (more
than 50 cc) may park only in motorcycle designated stalls, with permit, or metered stalls with a
concrete surface.
7. Vehicles shall be oriented in parking spaces such that they are directed with the flow of traffic
when leaving. Vehicles must be parked within painted lines where applicable.
8. Parking is prohibited on University streets or drives except where designated by official signs.
9. All traffic control signs and devices are in effect 24 hours, 7 days a week, unless otherwise
stated.
10. If an individuals’ vehicle becomes disabled (inoperable) on campus, the KSU Police and/or
KSU Parking Services shall be notified immediately. If vehicle is not removed or repaired
within 48 hours, it may be subject to impoundment and fines.
11. No vehicle shall be stored longer than 48 hours in parking areas other than residence hall lots,
nor shall any trailer or vehicle without a current license plate be parked or stored on University
property unless prior authorization is obtained from KSU Parking Services. It may be subject
to impoundment and fines.
12. During special events Parking Services has the authority to close selected lots to regular
permit holders and to collect fees for the use of parking facilities.
13. Car pools are encouraged.
14. Any current KSU parking permit is valid in the 'Z' lots, designated as C2 lot
(Recreation Center South), C3 lot (Edwards Hall), H14 lot (Foundation) and the
B17 lot (n. of Weber), except the CP Permits which are only valid in C1.
15. State/Government vehicles are not allowed to park in O and W lots for longer than 48 hours
unless the vehicle is parked in a reserved stall purchased for such vehicle. State/Government
vehicles must pay parking meters.

B. UNIVERSITY LIABILITY
The University assumes no duty for the care or protection of vehicles or their contents while the
vehicle is on property owned, leased, or otherwise controlled by the University.

C. AUTHORITY
1. Parking privileges may be modified or preempted by authority of the President of the University.
2. The Director of Public Safety and/or the Director of KSU Parking Services may alter, suspend, or modify parking fees and/or regulations as necessary to promote public safety or provide for the enhancement of the University, subject to review by the University Council on Parking Operations.

II: PARKING PERMITS

A. GENERAL REQUIREMENTS
1. Permits may be purchased only for use by the purchaser and are non-transferable. It is illegal to give false information on a permit application.
2. No parking permit shall be issued to any person having unpaid misuse fees.

B. PERMIT FEE SCHEDULE
(Fees pro-rated monthly)

<table>
<thead>
<tr>
<th>FACULTY/STAFF</th>
<th>Annual</th>
<th>Semester</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserved Stall (Includes (W) Permit)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 Hour</td>
<td>$600</td>
<td>Not available</td>
<td></td>
</tr>
<tr>
<td>10 Hour</td>
<td>$500</td>
<td>Not available</td>
<td></td>
</tr>
<tr>
<td>Government/State Vehicle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserved Stall (Includes (K) Permit)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$135</td>
<td>Not available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty/Staff (W) Permit</td>
<td>$85</td>
<td>$45</td>
<td>$15</td>
</tr>
<tr>
<td>Professor Emeritus (E) Permit</td>
<td>$0</td>
<td>$0</td>
<td></td>
</tr>
<tr>
<td>Jardine Terrace Combination Permit</td>
<td>$95</td>
<td>$50</td>
<td></td>
</tr>
<tr>
<td>Government/State Vehicle (K) Permit</td>
<td>$85</td>
<td>Not available</td>
<td></td>
</tr>
</tbody>
</table>

STUDENT

| Commuting Student (O) Permit | $60    | $35    | $10    |
| Residence Halls (R) or Jardine Terrace (J) Permit | $60    | $35    |
| Jardine Terrace Combination Permit | $70    | $40    |

OTHERS

| Motorcycle Permit            | $30    | $20    | $10    |
| Parking Meters               | As posted |
| Vendor/Contractor (Commercial) | $85    |
| Temporary Permits            | $10/month | $4/week | $1/day |
CP Permit $30 $20

SHUTTLE PASS (See Section II, F, 7, c) Per Individual Rider $50 $25

PERMIT DEFINITIONS:

CP Permits - Students only Recreation center Permits valid only in lot C-1, CP Lot.

O Permits - Commuting Students; valid in O, T and Z lots.

W Permits - Faculty/Staff; valid in W, T and Z lots.

E Permits - Professor Emeritus; valid in W, J, O, T and Z lots.

K Permits - Government/State; valid in K, T and Z lots.

V Permits - Visitors; valid in W, O, R, T and Z lots.

J Permits - Jardine Terrace; valid in J and Z lots.

R Permits - Residence Halls; valid in R lots (lot assignments are designated by Housing) and Z lots.

Faculty/staff permits, with the exception of Graduate Student Appointments of less than 0.4 time, may be purchased by payroll deductions. Payroll deduction procedures will be in accordance with Parking Services' policy established through cooperation with Payroll Services. Parking permits sold under the payroll deduction program must be returned to Parking Services when the permit holder retires, resigns, goes on leave without pay, goes on sabbatical leave, or goes on non-pay or non-faculty status.

REFUNDS

Refunds will be made for unused time on a permit when a written request is made and the permit returned to KSU Parking Services. Student requests for refunds will be forwarded to the Controller's Office for processing. Refunds will be pro-rated based on the date of the written request. Faculty/staff refunds for less than $20 will not be given.

C. STUDENT PERMITS

Student is defined as – Anyone other than full-time KSU employees currently enrolled or pre-enrolled in one or more academic credit hours of classes through Kansas State University.

1. Student annual parking permits are valid for the school year commencing the first day of classes of fall semester until the first day of classes the fall semester of the following year. Other permits expire as indicated on the permit.

2. Students living in residence halls may purchase only a residence hall parking permit; then may park only in lots assigned to them. When any hall resident moves out, such resident must exchange his/her residence hall parking permit for a general student permit.

3. Residents of Jardine Terrace must purchase a Jardine permit (only valid in Jardine Terrace) and may add a campus permit for an additional fee as given in the permit fee schedule. Vehicles must display a Jardine permit 12 months per year.

4. Rec Center Permits CP - Students may purchase a CP Permit as indicated in the fee schedule. CP Permits are valid only in lot C-1. C-1 is defined as Archery Road from the circle west of the Recreation Center, north to Kimball Ave.
   a. The CP permit is available for one year only, from July 1, 1999 to June 30, 2000.

D. FACULTY/STAFF PERMITS

Faculty/Staff is defined as – Any person engaged by KSU for teaching, extension, research, administration, service, or any person employed by an agency connected with or assigned to the University.
1. Faculty/Staff permits are valid from August 1 through July 31 of the following year.
2. Faculty/Staff permits must be purchased by such staff member. No University funds may be used to purchase such permits.
3. Residents of Jardine Terrace (See II, C, 3).

E. KSU-SALINA
Vehicles with KSU Salina campus parking permits issued by the Salina campus may park in any O, W, T or Z lots but not in residence hall lots or restricted areas. To be eligible for a Salina permit: Faculty must teach the majority of their courses at Salina, Staff must work the majority of their hours at Salina, and Students must take the majority of their credit hours at Salina.

F. SPECIAL PERMITS
1. Parking for Physically Disabled
   Physically Disabled is defined as – any individual with a physical impairment or condition that limits such individual's walking ability and results in an inability to travel unassisted more than 200 feet without the use of a wheelchair, crutch, walker, prosthetic, orthotic or other assistive device (K.S.A. 8-1, 124). Also stated as mobility impairment.
   a. Temporary medical permits that allow disabled faculty, staff, or students to use parking spaces designated for the physically disabled may be obtained through any Kansas Courthouse. Temporary medical permits must be displayed with a valid KSU parking permit.
   b. No person shall stop, stand, or park any vehicle in a parking space which is clearly marked as being reserved for the use of physically disabled persons or persons responsible for the transportation of physically disabled persons unless such vehicle displays a legal accessible parking identification device (pursuant to K.S.A. 8-161 or K.S.A. 8-1, 125, and amendments thereto) and is being operated by or used for the transportation of a physically disabled person requiring the use of that particular stall.
   c. Vehicles parked in accessible spaces must also display a KSU parking permit.
   d. Any physically disabled person requiring long term daily parking should apply for an individual reserved stall. There is no additional charge for a reserved stall issued to a physically disabled person. The reserved stall may be used only by the person to whom it is assigned. Vehicle must display a legal accessible parking identification device along with a valid KSU parking permit.
   e. Physically disabled individuals planning to attend special events on campus should contact Parking Services if special parking arrangements are required.
   f. Physically disabled persons may park in metered stalls (no charge), timed and loading zones as long as necessary if designated parking stalls are not available K.S.A. 8-1, 126.
   g. No person shall stop, stand, or park any vehicle or bicycle so that it blocks or restricts a ramp accessible to a wheelchair.
2. Visitors
   Defined as – any person who is not a KSU faculty/staff/student or vendor/contractor.
   a. All visitor vehicles, except in metered spaces, must display a visible, current visitor permit.
   b. Visitors are encouraged to park in lot D-1, west of Memorial Stadium on Denison Ave., with a visitor permit or in a meter stall. **Visitors are required to pay parking meters.** Visitors may receive “Visitor Permits” at the Information Booth located by the K-State Union on 17th Street. Information regarding the location of buildings and parking facilities can be obtained from the Information Booth, Parking Services, or Police Department.
   c. Visitors are allowed to park in O, W, T and Z lots only and must obey all traffic and parking regulations.
   d. Physically disabled visitors displaying a valid accessible parking identification device may use accessible stalls after obtaining a visitor’s permit.
   e. Frequent visitors who require parking on campus in excess of one calendar day per week must purchase a temporary, semester, or annual permit at the faculty/staff rate or use parking meters.
   f. Contact Parking Services to apply for other parking needs.
   g. Jardine Terrace residents, in addition to receiving a permanent visitors permit as an "Inventory Item," may also obtain guest parking permits from the Jardine manager, Parking Services, or Police Department. On no occasion should a visitor/guest permit be displayed on vehicles registered to Jardine residents.

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h. Board of Regents members’ parking identifications will be honored for parking in any O, W, T or Z parking lots or metered parking stalls.

i. Only one citation issued to visitors for “NO VALID PERMIT/AUTHORIZATION” per 12 month period may be excused as long as vehicle was otherwise legally parked. Complete information on back of citation, circle “Visitors See Reverse Side” on front of citation and send to Parking Services within 8 business days from date of citation.

3. Conference Permits
   A department of individual may obtain conference permits by requesting the number of permits required and the reason for such issuance. Daily and weekly permits are available.

4. Reserved Stalls
   (No new applications are currently being accepted.)
   Only faculty/staff members may apply for a reserved stall. After an application for a reserved stall is received, the applicant’s name will be maintained on the reserved stall waiting list. When a stall becomes available, it will be assigned on a first come, first served basis. When University duties are the basis of the request, and those duties require frequent trips per week on or off campus, the department head may request that the cost of the reserved stall be paid by the employer. Reserved stalls for government/state vehicles may be granted, but must be purchased as indicated in the fee schedule.

5. Service Permits/Stalls
   Vehicles must display a service permit to park in service stalls. While using a service permit, a valid faculty/staff, student or state vehicle permit must also be displayed. Vehicles displaying service permits may park in service stalls and loading zones in accordance with the posted time limit. Service stalls are to be used primarily for loading and unloading purposes only. If a service permit/stall is misused, a notice of violation may be received by the owner of the vehicle and revocation of the permit may result. The Council on Parking Operations reserves the right to limit the number of service permits issued and to review applications.

6. Vendor/Contractor
   Defined as – A person representing a company or self in order to sell a product or service on campus. Vendors or contractors shall acquire a Vendor/Contractor permit and may utilize the service stalls and loading zones under the service stall regulations with exception of that no other permit is needed (See paragraph above). Also valid in any O, W, T or Z lots.

7. Other
   a. Special permits are available for motorcycles, convertibles, and unlockable vehicles.
   b. Requests for special parking privileges, or conditions not specifically covered in these regulations, will be considered by the Council on Parking Operations upon written request, giving full justification. The Council meets monthly when school is in session, and other times when necessary.
   c. A shuttle may operate among several University buildings that are located off-campus or at the periphery of the main campus. A fee to ride the shuttle may be necessary to keep the vehicle in operation. The fee will be in accordance with the fee schedule. A fee card from Parking Services will be available to individuals who purchase the shuttle pass.

G. PERMIT DISPLAY, REMOVAL, REPLACEMENT
   1. Movable parking permits must be hung on the inside rearview mirror and be clearly visible from outside the vehicle.
   2. Parking permits become invalid when registrant withdraws from, or otherwise terminates association with the University.
   3. Custody of parking permits is the owner’s responsibility. In the event a permit is lost or stolen, inform KSU Parking Services and/or KSU Police. A replacement permit may be obtained for the current prorated cost of an annual permit. Damaged permits may be exchanged without cost.
   4. Only one permit at a time may be displayed. Vehicles may not display a visitor permit along with a Faculty/Staff or Student permit. The only exception is the requirement to display a state handicapped permit with KSU parking permit.

H. FORGED, STOLEN, OR ALTERED PARKING PERMITS
   Displaying forged, stolen (lost), or altered parking permits is prohibited. Such violations will be treated as a theft of services and/or an honor code violation in addition to a parking violation. Vehicles and permits involved will be impounded. Parking privileges may be revoked up to 1 year
and individuals involved will be reported to the appropriate authorities.

III: DRIVING REGULATIONS

A. All state driving laws are in effect on campus. Tickets issued for moving violations are processed by Manhattan Municipal Court and/or Riley County District Court.

B. Motorized vehicles driven on the campus must be operated with caution, compatible with existing weather, pedestrian and vehicular traffic conditions, and at no time in excess of 20 miles per hour or posted speed limit. Speeds may be checked by radar.

C. Motorized vehicles (except wheelchairs), motor bikes, scooters, motorcycles, MOPEDS, and bicycles shall not be operated on the grass sidewalks, or pedestrian walkways of the campus.

D. Snow Emergency Routes
   All campus streets and drives are designated as snow emergency routes when so declared by the President of the University or the designated representative. Vehicles blocking these routes are subject to fine and/or towing charges.

IV: BICYCLES/ SKATEBOARDS

(See Bicycle Regulations for more details).

A. All persons parking a bicycle, including unicycles and tricycles, on campus are required to register it at no charge with the KSU Parking Services and display a registration permit. Non-University affiliated persons may register a bike.

B. Bicycles shall be parked at and attached to bicycle racks only.

C. Bicycles shall not be taken inside a building without the written permission of the building proctor and then not in public areas or in any place where they may constitute a safety hazard.

D. Bicyclists shall obey all motor vehicle traffic rules and be liable for applicable fines and penalties. In addition and in accordance with posted signs, bicyclists must ride on designated bike paths and lanes when available.

E. In the event that a bicycle has been impounded for a violation of the bicycle regulations, a $10.00 release fee shall be assessed in addition to the misuse fee.

F. Skateboarding is prohibited on campus sidewalks, parking lots, streets, drives, and other paved areas adjacent to and inside University buildings. Skateboarding is permitted for individual transportation in University bike lanes.

G. The use of in-line skates, roller blades, roller skates, or similar devices, is only permitted on joint use bicycle and pedestrian pathways and bike lanes. (See Bicycle Guide and Regulations and/ or Skating on Campus pamphlet.)

V: ENFORCEMENT/ MISUSE FEES/ PENALTIES/ APPEALS

A. ENFORCEMENT
   1. KSU Police Officers/Parking Control Officers
      KSU Police Officers are appointed by the Kansas Board of Regents, and have authority to halt motor vehicles, issue citations for violations, order vehicles impounded by towing or by applying wheel locks, and to enforce traffic regulations. KSU Parking Control Offices, appointed by the Administration of KSU Parking Services, shall have authority to issue citations for parking violations.
   2. Responsibility for Compliance
      All parking fines assessed to a vehicle are the responsibility of the KSU permit holder; state registered vehicle owner; or connected KSU faculty/staff/student. Organizational units may
transfer responsibility for any citation issued them, by notifying Parking Services in writing of the University employee responsible for the vehicle at the time of the infraction.

3. Impounding
Any vehicle parked upon any University facility in violation of these regulations can be deemed a common nuisance and will be removed and impounded. The cost of each removal and impoundment shall be a lien against the motor vehicle until paid by the owner or the owner's representative. If the event a vehicle is not towed, but a wheel lock applied, there will be a $20.00 removal fee charged. These fees cannot be appealed.

4. Client Parking
Citations received on legally parked client's vehicles using client parking stalls at Lafene; Veterinary Hospital; Speech-Hearing; etc. may be presented to the receptionist at the respective building for validation. Clients must present or send the validated citation to Parking Services for cancellation within eight (8) business days from date of citation.

B. MISUSE FEES
Misuse fees are payable at Parking Services or can be deposited in any of the yellow misuse fees boxes located at various locations in meter lots and Edwards Hall. It is recommended that such payment be made by check. Misuse fees paid after eight (8) business days (unless the citation is under appeal) are delinquent and will be assessed a $5.00 late fee.

Parking Violations:
A vehicle may be re-ticketed for the same violation if the violation has not been corrected by the next calendar day or vehicle has moved. This provision does not apply to violations 1, 2 or 8.

Windshield notes and/or hazard lights will not be recognized when a vehicle is parked illegally.

1. VIOLATION WARNING – A warning of being in violation.
2. $5.00 EXPIRED METER – Meter violations are $5.00 if paid within eight (8) business days, $10.00 thereafter. Vehicles may be re-ticketed based on the time limit posted on the respective meter.
3. $15.00 MUTILATED/UNREADABLE PERMIT – Displaying a damaged, mutilated or unreadable/improperly displayed parking permit.
4. $15.00 NO VALID PERMIT/AUTHORIZATION – No valid parking permit or authorization displayed or visible.
5. $15.00 NOT WITHIN MARKED STALL - Vehicle not within marked parking stall.
6. $15.00 NO PARKING AREA - Parking in an area not specifically designated as a parking area for motor vehicles.
7. $15.00 PARKED IN WRONG AREA - Parking in an area other than specified on the permit.
8. $15.00 OVERTIME PARKING – Overtime parking in an area regulated by a time limited sign.
9. $15.00 WRONG SIDE OF THE STREET – Parked parallel to the street on wrong side of street or parking apron or diagonal parking stall facing oncoming traffic.
10. $15.00 CLIENT PARKING – Parked in reserved client stall.
11. $15.00 OTHER – Any other parking deemed inappropriate.
12.- 24. - Vehicles may be impounded and a towing and/or wheel lock removal fee be assessed in addition to the misuse fee.

12. $30.00 BLOCKING DRIVE OR VEHICLE – Blocking drive, roadway, or vehicles, including illegally parked vehicles.
13. $30.00 RESTRICTING TRAFFIC FLOW – Restricting normal flow of traffic.
14. $30.00 UNAUTHORIZED STORAGE – Unauthorized storage of a vehicle or trailer on Kansas State University property.
15. $30.00 EXCESSIVE VIOLATOR - Under Other Penalties, see C.4
16. $30.00 RESERVED STALL – Illegally parked in a designated reserved stall.
17. $30.00 SERVICE STALL/PERMIT – Illegally parked in a designated service stall or improper use/violation of terms for a service permit.
18. $30.00 OTHER – Any other parking deemed as a violation or an unsafe condition.
19. $60.00 FIRE LANE/HYDRANT – Parking in designated fire lane or adjacent to fire hydrant/standpipe connections (within 15 feet of curb in all directions).
20. $100.00 ACCESSIBLE STALL/RAMP - Illegally parking in a space designated for the physically disabled or blocking an access ramp (in accordance with K.S.A. 1995 Supp. 8-1, 130A as passed by the 1995 Kansas Legislature).
21. - 24. - Permits must be surrendered to KSU Parking Services or the Department of University Police upon notification.

21. $85.00 FORGED, ALTERED, OR STOLEN PERMIT - Displaying a forged, altered, or lost/stolen parking permit.
22. $60.00 ILLEGAL REGISTRATION – Misrepresentation or illegal registration.
23. $60.00 OTHER – Any other parking deemed as a violation by KSU Parking Services or the Department of University Police.
24. $100.00 ILLEGAL DISABLED PLACARD – Illegally displaying a stolen, altered, expired or unauthorized accessible parking identification device.

Moving Violations:
Notices to Appear for moving violations are processed by the Riley County District Court, Manhattan Municipal Court, or the Courts of the 21st Judicial District.

Bicycle Violations: (See Bicycle Regulations)
Skateboard Violations:
$15.00 Skateboarding on sidewalk, parking lots, paved areas adjacent to buildings, or inside buildings.

$15.00 Skating or cycling on building rails, steps, retaining or landscape walls, benches, handrails, etc.

C. OTHER PENALTIES
1. Students – Students having unpaid fees will not be permitted to re-enroll, drop/add, or receive a transcript or records.
2. Faculty/Staff – Parking Permits must be returned to Parking Services and outstanding fees paid upon termination of employment. Failure to comply may result in legal action.
3. Delinquent accounts may be forwarded to a collection agency and/or the Set-off program as created in K.S.A. 75-6201.
4. A vehicle parked on University property having three (3) or more delinquent parking citations or having five (5) or more unpaid citations is deemed an "Excessive Violator" and is subject to impoundment. Any vehicle impounded under this section may not be released until all citations and impoundment fees have been paid or payment arrangements have been made to the satisfaction of Parking Services and/or the designated towing service company.

D. APPEALS
The KSU Parking Citations Appeals Board (PCAB) was established by the University to review the validity of violation notices when a review is requested by the violator. The procedures are:
1. An Appeals Form must be completed, filed, reviewed, and recorded at Parking Services by the close of business on the eighth business day after the issuance of the violation notice. PCAB may uphold or dismiss the violation. Paid tickets may not be appealed. Appeals made after eight (8) business days from the date of the violation will not be accepted.
2. All actions of PCAB are final.
3. All penalties must be paid within eight (8) business days following the decision date of PCAB. Failure to do so may result in the impoundment of the vehicle.

Revised 05/21/99
BUILDING DEFINITIONS AND DATA ELEMENTS

This chapter provides the technical definitions, measurement procedures, and coding structures for building data elements. The interrelationships between these components of building area are illustrated by the conceptual framework in Figure 1.

Definitions of Building Areas

The definitions and procedures provided in this chapter are intended to clarify and provide guidelines for the most commonly used types of data to be collected and compiled on buildings. These guidelines are based on the definitions and standards established during the 1960’s for the Federal Construction Council and published by the National Academy of Sciences. The Federal Construction Council standards were intended for use by federal agencies, but they have been widely adopted and used by colleges and universities.

The definitions and guidelines in this chapter attempt to clarify and update some of the earlier standards by providing additional guidance on how to interpret and apply measurement procedures. The guidelines also are intended to establish a common standard for the minimum amount of data to be included in a building inventory in order to provide a database that is usable for both intra-institutional and inter-institutional purposes. Institutions are not precluded by these guidelines from collecting additional building data or from including other types of structures in their facilities inventory.

1. Gross Area

A. Definition: The sum of all areas on all floors of a building included within the outside faces of its exterior walls, including floor penetration areas, however insignificant, for circulation and shaft areas that connect one floor to another.

B. Basis for Measurement: Gross area is computed by physically measuring or scaling measurements from the outside faces of exterior walls, disregarding cornices, pilasters, buttresses, etc., which extend beyond the wall faces. Exclude areas having less than a six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

Measured in terms of gross square feet (GSF),

\[ \text{Gross Area} = \text{Net Usable Area} + \text{Structural Space} \]

C. Description: In addition to all the internal floored spaces obviously covered above, gross area should include the following: excavated basement areas; mezzanines, penthouses, and attics; garages; enclosed porches, inner or outer balconies whether walled or not, if they are utilized for operational functions; and corridors whether walled or not, provided they are within the outside face lines of the building, to the extent of the roof drip line. The footprints of stairways, elevator shafts, and ducts (examples of building infrastructure) are to be counted as gross area on each floor through which they pass.

D. Limitations: Exclude open areas such as parking lots, playing fields, courts, and light wells, or portions of upper floors eliminated by rooms or lobbies that rise above single-floor ceiling height.

E. Exception: Include top, unroofed floor of parking structures where parking is available. (See the section on Parking Structures at the end of this chapter.)

2. Assignable Area (Net Assignable Square Feet – NASF)

A. **Definition:** The sum of all areas on all floors of a building assigned to, or available for assignment to, an occupant or specific use.

B. **Basis for Measurement:** Assignable area is computed by physically measuring or scaling measurements from the inside faces of surfaces that form the boundaries of the designated areas. Exclude areas having less than a six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

Measured in terms of assignable square feet (ASF),

\[
\text{Assignable Area} = \text{Sum of Area Designated by the Ten Assignable Major Room Use Categories.}
\]

C. **Description:** Included should be space subdivisions of the ten major room use categories for assignable space – classrooms, labs, offices, study facilities, special use, general use, support, health care, residential and unclassified – that are used to accomplish the institution’s mission.

D. **Limitations:** Deductions should not be made for necessary building columns and projections. Areas defined as building service, circulation, mechanical, and structural should not be included.

3. Nonassignable Area

A. **Definition:** The sum of all areas on all floors of a building not available for assignment to an occupant or for specific use, but necessary for the general operation of a building.

B. **Basis for Measurement:** Nonassignable Area is computed by physically measuring or scaling measurements from the inside faces of surfaces that form the boundaries of the designated areas. Excludes areas having less than six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

Measured in terms of area,

\[
\text{Nonassignable Area} = \text{Sum of the Area Designated by Three Nonassignable Room Use Categories.}
\]

C. **Description:** Included should be space subdivisions of the three nonassignable room use categories – building service, circulation and mechanical – that are used to support the buildings’ general operation.

D. **Limitations:** Deductions should not be made for necessary building columns and projections. Areas defined as assignable should not be included.

4. Building Service Area

A. **Definition:** The sum of all areas on all floors of a building used for custodial supplies, sink rooms, janitorial closets, and for public rest rooms. (NOTE: Building service area includes all areas previously classified as custodial area. Building service area also includes public rest rooms that were previously classified as mechanical area. Building Service Area does not include assignable areas (e.g., areas classified as 730-Central Storage and 870-Central Supplies are not part of Building Service Area).
B. **Basis for Measurement:** Building service area is computed by physically measuring or scaling measurements from the inside faces of surfaces that form boundaries of the designated areas. Exclude areas having less than a six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

C. **Description:** Included should be janitor closets or similarly small cleanup spaces, maintenance material storage areas, trashrooms exclusively devoted to the storage of nonhazardous waste created by the building occupants as a whole, and public toilets.

D. **Limitations:** Deductions should not be made for necessary building columns and minor projections. Areas defined as central physical plant shop areas, or special purpose storage or maintenance rooms, such as linen closets and housekeeping rooms in residence halls, should not be included. Does not include private rest rooms.

5. **Circulation Area**

A. **Definition:** The sum of all areas on all floors of a building required for physical access to some subdivision of space, whether physically bounded by partitions or not.

B. **Basis for Measurement:** Circulation area is computed by physically measuring or scaling measurements from the inside faces of surfaces that form the boundaries of the designated areas. Exclude areas having less than a six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

C. **Description:** Included should be, but is not limited to, public corridors, fire towers, elevator lobbies, tunnels, bridges, and each floor’s footprint of elevator shafts, escalators and stairways. Receiving areas, such as loading docks, should be treated as circulation space. Any part of a loading dock that is not covered is to be excluded from both circulation area and the gross building area. A loading dock which is also used for central storage should be regarded as assignable area and coded as central storage (730). Also included are corridors, whether walled or not, provided they are within the outside facelines of the buildings to the extent of the roof drop line.

D. **Limitations:** Deductions should not be made for necessary building columns and minor projections. When determining corridor areas, only spaces required for public access should be included. Restricted access private circulation aisles used only for circulation within an organizational unit’s suite of rooms, auditoria, or other working areas should not be included.

6. **Mechanical Area**

A. **Definition:** The sum of all areas on all floors of a building designed to house mechanical equipment, utility services, and shaft areas.

B. **Basis for Measurement:** Mechanical area is computed by physically measuring or scaling measurements from the inside faces of surfaces that form the boundaries of the designated areas. Exclude areas having less than six-foot, six-inch clear ceiling height unless the criteria of a separate structure are met.

C. **Description:** Included should be mechanical areas such as central utility plants, boiler rooms, mechanical and electrical equipment rooms, fuel rooms, meter and communications closets, and each floor’s footprint of air ducts, pipe shafts, mechanical service shafts, service chutes, and stacks.

D. **Limitations:** Deductions should not be made for necessary building columns and projections. Areas designated as private toilets are not included.
7. Net Usable Area

A. Definition: The sum of all areas on all floors of a building either assigned to, or available for assignment to, an occupant or specific use, or necessary for the general operation of a building.

B. Basis for Measurement: Net usable area is computed by summing the assignable area and the nonassignable area.

Measured in terms of net usable square feet (NUSF),

\[
\text{Net Usable Area} = \text{Assignable Area} + \text{Nonassignable Area}.
\]

C. Description: Included should be space subdivisions of the ten assignable major room use categories and the three nonassignable space categories.

D. Limitations: Deductions should not be made for necessary building columns and projections. Areas defined as structural should not be included.

8. Structural Area

A. Definition: The sum of all areas on all floors of a building that cannot be occupied or put to use because of structural building features.

B. Basis for Measurement: Precise computation by direct measurement is not possible under these definitions. It is determined by calculating the difference between the measured gross area and the measured net usable area.

Measured in terms of area,

\[
\text{Structural Area} = \text{Gross Area} - \text{Net Usable Area}.
\]

C. Description: Examples of building features normally classified as structural areas include exterior walls, fire walls, permanent partitions, unusable areas in attics or basements, or comparable portions of a building with ceiling height restrictions, as well as unexcavated basement areas.

Other Building Information

1. Estimated Replacement Cost

A. Definition: The estimated cost to replace the building at the time of inventory.

B. Basis for calculation: Determined in terms of the cost to replace the building’s gross floor area at current construction costs in accordance with current building and public safety codes, and standard construction methods. The Engineering New Record, R.S. Means\(^3\), or Boeckh\(^4\) are examples of frequently used sources of

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\(^2\) Referred to as “construction area” in TR-50.

\(^3\) R.S. Means Company, Inc., Construction Consultants and Publishers, publishes an historical cost index. In addition, the Commercial/Industrial/Institutional section of one of the Means’ manuals contains base building costs per square foot or floor area for seventy model buildings.
information for determining construction cost indices. The selected source of information should be locally determined. The replacement cost of fixed equipment in the building should be included.

2. Condition

A. Definition: The physical status of the building at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition of the campus.

B. Derivation: The most useful facilities management information is produced when the inventory or audit rates each subsystem of a building. This approach documents the building's overall composite rating and provides information about needed repairs or replacements. A facilities audit should tie subsystem and overall composite ratings to the estimated building replacement value to provide a rough estimate of the cost of rehabilitating or renovating the facility.\(^5\)

\(^4\) The Boeckh Division of the American Appraisal Company computes a construction cost index that appears applicable to the mix and types of buildings found on college and university campuses. The index is reported in the *Higher Education Price Indexes* by Research Associates of Washington (Washington, D.C.).

CHAPTER 11 – APPENDICES

APPENDIX 15 – AREAS OF RESCUE ASSISTANCE
CHAPTER 11 – APPENDICES

APPENDIX 16 – MODIFIED BITUMINOUS MEMBRANE ROOFING
Appendix 16: Modified Bituminous Membrane Roofing

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APP 16-3
January 2013
L. Current Copy

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         a. Garland Co.
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c. Performance
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2. Polyisocyanurate Board Insulation
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      1. Thickness
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      3. Elongation at Maximum Load
      4. Tear Strength
      5. Low-Temperature Flexibility

2.3 SBS-Modified Bituminous Sheet
   A. SBS-Modified Bituminous Sheet, Smooth Surfaced
      1. Use
      2. Reinforcing
   B. SBS-Modified Bituminous Sheet, Mineral-Granule Surfaced
      1. Use
      2. Reinforcing
      3. Granule Color
   C. Physical Properties
      1. Thickness
      2. Tensile Strength
      3. Elongation at Maximum Load
      4. Tear Strength
      5. Low-Temperature Flexibility

2.4 Auxiliary Membrane Materials
   A. General
      1. Auxiliary Materials
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      1. Labeling
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L. Roofing Granules
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2.5 Insulation Materials
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   B. Phased Application – Not Permitted
   C. Location of Special Sensitivity
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   E. Shingling Plies
      1. Backnail
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      1. Provide
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3.4 Insulation Installation
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   I. Attached Insulation, Concrete Deck
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3.5 Roof Membrane Installation
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   2. Apply
D. Install
   1. Install – Shed Water
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A. Install
   1. Metal Components
   2. Prime
   3. Back Sheet Application
   4. Backer Sheet Application
   5. Base Flashing Application
   6. Base Flashing
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C. Fasten Top
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3.7 Field Quality Control
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   1. 48 Hour Notice

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A. Protect During Construction Period
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3.9 Roofing Installer's Warranty
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   1. Owner
   2. Address
   3. Building Name/Type
4. Address
5. Area of Work
6. Acceptance Date
7. Warranty Period
8. Expiration Date

B. WHEREAS
C. THEREFORE
D. Terms and Conditions
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      a. Lightning
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   2. Name
   3. Title

END OF SECTION 07551
SECTION 07551 – MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Two-ply, modified bituminous membrane roofing.
2. Roofing insulation.

B. Related Sections include the following:

1. Division 6 Section "Miscellaneous Carpentry" for wood blocking, curbs, cants, and nailers; and wood-based, structural-use roof deck panels.
2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
3. Division 7 Section "Manufactured Roof Specialties."
4. Division 7 Section "Roof Accessories."
5. Division 7 Section "Roof Expansion Assemblies."
6. Division 7 Section "Joint Sealants."
7. Division 15 Section "Plumbing Specialties" for roof drains.
8. Division 16 Section "Lightning Protection."

C. Unit Prices: Refer to Division 1 Section "Unit Prices" for description of Work in this Section that is affected by unit prices.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definitions of terms related to roofing work not otherwise defined in this Section.

B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt within a range of plus or minus 25 deg F measured at the mop cart or mechanical spreader immediately before application.

1.4 PERFORMANCE REQUIREMENTS

A. General: Install a watertight, modified bituminous membrane roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure. Roofing system shall consist of tapered polyisocyanurate insulation attached in either cold adhesive or a hot mopping of asphalt, two (2) layers of modified bituminous membrane roofing membranes of either SBS or APP modifiers laid down in manufacturer recommended cold adhesive. Roofing membranes shall meet the minimum requirements as specified in sections 2.2 and 2.3.
B. FM Listing: Provide modified bituminous membrane, base flashings, and component materials that meet requirements of FM 4450 and FM 4470 as part of a roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM markings.

1. Roofing system shall comply with the following:
   a. Fire/Windstorm Classification: Class 1A-90.

1.5 SUBMITTALS

A. Product Data: For each type of roofing product specified, include data substantiating that materials comply with requirements, including product specifications, installation instructions, and general recommendations for the following:

1. Roofing Specification
2. Insulation and Insulation Adhesives
3. Modified Bitumen Membranes and Base Sheet
4. Modified Bitumen Adhesives
5. Metal Flashing and Sealants

B. Shop Drawings: Include plans, sections, details, and attachments to other work, for the following:

1. Base flashings, cants, and membrane terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.

C. Samples for Verification: Of the following products:

1. 12-by-12-inch square of modified bituminous, granule-surfaced cap sheets, of color specified.
2. 12-by-12-inch square of roofing insulation.
3. 6 insulation fasteners of each type, length, and finish.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system and is eligible to receive the standard roofing manufacturer's warranty. The manufacturer's certification shall be submitted as part of the bid.

E. Manufacturer Certificates: Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of complying with requirements.

F. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.

G. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.
H. Research/Evaluation Reports: Evidence of roofing system’s compliance with building code in effect for Project from a model code organization acceptable to authorities having jurisdiction.

I. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.

J. Warranty: Sample copy of standard roofing manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.

K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roof installation.

L. Current copy of the general specification recommendations and the recommended installation specifications of all systems of the proposed roofing system manufacturer. These publications will not be returned at the close of the project. The Roofing Contractor is to keep a copy of the same publications at the job site at all times for the duration of the contracted work.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing roofing similar to that required for this Project for not less than five (5) years; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the standard roofing manufacturer's warranty. Roof Installer to engage workers who are experienced with similar types of installations.

B. Superintendent Qualifications: Engage an experienced superintendent to manage installation of the Work of this Section who has specialized in installing roofing similar to that required for this Project for not less than five (5) years; who has received specific training by the roofing system manufacturer to install manufacturer's product; and who has functioned in a superintendent capacity on at least ten (10) roofing projects similar to that required for this Project.

C. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; complying with ASTM E 108, for application and slopes indicated.

D. Preinstallation Conference: Approximately two (2) weeks prior to the scheduled commencement of the roofing installation and associated work, conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Notify participants at least 5 working days before conference.

1. Meet with Owner; Architect; Owner's insurer, if applicable; testing and inspecting agency representative; roofing installer and roofing installers construction foreman for this project; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and attachment to structural members.
4. Review loading limitations of deck during and after roofing.
5. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
6. Review governing regulations and requirements for insurance, certifications, and inspection and testing, if applicable.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.
9. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.
10. Establish which areas on the site will be available for use as storage and work areas, and the Roofing Contractor's responsibility of protection and restoration of said storage and work areas to pre-construction conditions.
11. Review University parking requirements, regulations, and the procedure for the Roofing Contractor and his employees to obtain permits for parking during the course of the work. Any parking fees and/or fines are the responsibility of the Roofing Contractor.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location to ensure no significant moisture pickup and maintain at a temperature exceeding roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
2. No more material should be stored at the job site than will be used within two weeks. For expected storage periods greater than two weeks, the material should be properly warehoused.

B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 50 deg F. Shipping wrappers are not acceptable field storage covers. All waterproof tarps shall be opaque. The Roofing Contractor shall visit the site on a daily basis to inspect the storage conditions of the materials.

C. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

D. Protect roofing insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturers' written instructions for handling, storing and protecting during installation.

E. All materials may be checked by use of moisture meter for acceptance prior to application and while being installed, at the option of the Architect.

F. No materials containing asbestos are to be used, in any form, on any project. No products containing asbestos will be allowed to be stored on site. Any materials containing asbestos will be removed promptly.
1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements. Do not apply roofing membrane during inclement weather or when ambient temperature is below forty (40) degrees Fahrenheit including wind chill factor. Do not apply roofing membrane to damp or frozen surface.

B. After rains or dew, no material will be applied until all moisture has dissipated from roof surface.

C. The existing roof deck is assumed to be sloped, and it is the responsibility of the Roofing Contractor to verify any variations. If a variation should be discovered, the Roofing Contractor shall notify the Architect immediately and receive instruction before any further work can proceed.

D. If found necessary and requested by the Roofing Contractor, The Kansas State University Facilities Planning Office will survey the roof deck at no cost to the Roofing Contractor to assist in identifying variations in the deck that may produce unacceptable water ponding.

E. Kansas State University personnel will disconnect all electrical work and mechanical piping on the roof as required for the reroofing of the building and will do other work as required by plans and specifications. On completion of the work, Kansas State University personnel will reconnect all electrical and mechanical services.

F. The Roofing Contractor shall verify the location of all sources of power and insure that such sources are compatible with the requirements of the tools for installation of the new roofing system. If the sources of appropriate power do not exist or are not available, the Roofing Contractor shall supply an appropriate source at the Roofing Contractor's expense.

1.9 WARRANTY

A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Standard Roofing Manufacturer's Warranty: Submit a written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in the roof membrane and base flashings resulting from defects in materials or workmanship for the following warranty period:

1. Warranty Period: 10 years base bid.
2. Warranty Period: 20 years alternate no. 1.

C. Special Project Warranty: Submit roofing Installer's warranty on warranty form at end of this Section, signed by Installer, covering Work of this Section, including membrane roofing, base flashing, roofing insulation, fasteners, and vapor retarders, if any, for the following warranty period:

1. Warranty Period: 2 years from date of Substantial Completion.
2. Such repair or replacement of defects shall include, but not be limited to: splits, blisters, bare spots, fishmouths, wrinkles, slippage and metal work. Repair or
replacement may be required due to visual defects and not necessarily limited to defects with resulting roof leaks.

3. Upon notice of roofing leaks or defects, the roofing Contractor shall promptly inspect the defective areas and make all necessary repairs, including labor and materials, at no expense to Kansas State University, with no dollar limit.

4. The Roofing Contractor is to meet and administer the minimum requirements of the roofing system manufacturer and the requirements of these specifications for inspection of the roof system.

5. The Roofing Contractor shall maintain a copy of the drawings, specifications, and the roofing manufacturer’s specifications at the job site at all times.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Modified Bituminous Sheet:
   a. Garland Co., Inc. (The).
   b. Johns-Manville Roofing Systems
   c. Performance Roof Systems, Inc.
   d. Siplast
   e. Tremco, Inc.
   f. Derbigum

2. Polyisocyanurate Board Insulation:
   a. Apache Products Co.
   b. Atlas Roofing Corporation
   c. NRG Barriers, Inc.
   d. Celotex Corp. (The).

B. Should a bidder wish to incorporate, in the base proposal, brands or products other than those named in the Specifications, he shall submit written request for substitution approval to the Project Architect/Engineer ten (10) calendar days prior to date proposals are due. Approved substitutions will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner.

C. Products submitted for request for substitution shall meet the minimum requirements as shown in sections 2.2 and 2.3 below within +/- 7%. Any products not meeting the above criteria will not be approved for substitution.

2.2 APP-MODIFIED BITUMINOUS SHEET

A. APP-Modified Bituminous Sheet, Smooth Surfaced: Atactic-polypropylene-modified asphalt sheet, smooth surfaced; suitable for application method specified; manufacturer’s standard thickness and weight; for use and of reinforcing type as follows:

1. Use: Base ply of 2-ply, modified bituminous membrane roofing.
2. Reinforcing: Woven or nonwoven polyester.

B. APP-Modified Bituminous Sheet, Mineral-Granule Surfaced: Atactic-polypropylene-modified asphalt sheet, reinforced, with continuous layer of mineral granules factory applied to top exposed surface and a plastic film on bottom surface; suitable for
application method specified; manufacturer's standard thickness and weight; for use and of reinforcing type and granule color as follows:

1. Use: Finish ply of 2-ply, modified bituminous membrane roofing and base flashing.
2. Reinforcing: Woven or nonwoven polyester.

C. Physical Properties: Provide APP-modified bituminous membrane materials with the following properties when tested according to ASTM D 5147:

1. Thickness: 157 mils base ply, 177 mils finish ply.
2. Tensile Strength: 150 lbf/in base ply, 203 lbf/in finish ply at 0 deg F in each direction.
3. Elongation at Maximum Load: 4.0 percent at 0 deg F.
4. Tear Strength: 158 lbf base ply, 170 lbf finish ply.
5. Low-Temperature Flexibility: Pass at -13 deg F.

2.3 SBS-MODIFIED BITUMINOUS SHEET

A. SBS-Modified Bituminous Sheet, Smooth Surfaced: SBS-modified asphalt sheet, smooth surfaced, dusted with fine parting agent on both sides; suitable for application method specified; manufacturer's standard thickness and weight; for use and of reinforcing type as follows:

1. Use: Base ply of 2-ply, modified bituminous membrane roofing.
2. Reinforcing: Glass-fiber mesh or nonwoven glass-fiber mat.

B. SBS-Modified Bituminous Sheet, Mineral-Granule Surfaced: SBS-modified asphalt sheet, with continuous layer of mineral granules factory applied to top exposed surface; suitable for application method specified; manufacturer's standard thickness and weight; for use and of reinforcing type and granule color as follows:

1. Use: Finish ply of 2-ply, modified bituminous membrane roofing and base flashing.
2. Reinforcing: Woven or nonwoven polyester.

C. Physical Properties: Provide SBS-modified bituminous membrane materials with the following properties when tested according to ASTM D 5147:

2. Tensile Strength: 125 lbf/in base ply, 150 lbf/in finish ply at 0 deg F.
3. Elongation at Maximum Load: 4% at 0 deg F.
4. Tear Strength: 120 lbf base ply, 150 lbf finish ply.
5. Low-Temperature Flexibility: Pass at -13 deg F.

2.4 AUXILIARY MEMBRANE MATERIALS

A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with APP-modified bituminous roofing.

1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.

B. Asphalt Primer: ASTM D 41.
C. Roofing Asphalt: ASTM D 312, Type III, as recommended by modified bituminous membrane manufacturer.

1. Label each container or provide certification with each load of bulk asphalt identifying type of roofing asphalt and indicating softening point, minimum flash point, equiviscous temperature, and finished blowing temperature.

D. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, 1- or 2-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with modified bituminous membrane roofing and flashings.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application. Asphaltic roofing cement is considered a waterproofing agent but is not a weatherproofing agent. In no instance will roofing cement be allowed as part of the exposed final roof system. The contractor will make every effort to limit the use of roofing cement except as allowed in the details. If roofing cement is used as a temporary method of waterproofing, all roofing cement shall be removed prior to the application of the final roof system.

F. Mastic Sealant: Polyisobutylene, plain or modified bituminous, nonhardening, nonmigrating, nonskinning, and nondrying.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470; designed for fastening base sheets, base-ply felts, and base flashings and for backnailing modified bituminous membrane to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer.

H. Metal Flashing Sheet: Metal flashing sheet is specified in Division 7 Section "Sheet Metal Flashing and Trim."

I. Wood Nailer Strips: Furnish wood nailer strips complying with requirements of Division 6 Section "Miscellaneous Carpentry."

J. Cants: Wood cants are specified in Division 6 Section "Miscellaneous Carpentry."

K. Cants: Fiberglass board, complying with ASTM C 728.

L. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100% passing No. 8 sieve and 98% of mass retained on No. 40 sieve.

1. Color: To match color of cap sheet.

M. Glass-Fiber Fabric: Woven glass cloth, treated with asphalt; complying with ASTM D 1668, Type 1.

N. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer for intended use.

2.5 INSULATION MATERIALS

A. General: Provide preformed roofing insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated.
1. Provide preformed tapered insulation boards where indicated for sloping to drain. Fabricate with the following taper:
   a. ¼ inch per 12 inches, unless otherwise indicated.

2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated and as required for sloping to drain.

B. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents, complying with ASTM C 1289, facer type as follows:
   1. Facer Type: As recommended by manufacturer.

2.6 INSULATION ACCESSORIES
A. General: Furnish roofing insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.
B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470, designed for fastening roofing insulation to substrate, and acceptable to roofing system manufacturer.
C. Tapered Edge Strips: Rigid, perlite insulation board, complying with ASTM C 728.
D. Cover Board: Rigid, glass-fiber insulation board, complying with ASTM C 726, ¾ inch thick.

PART 3 – EXECUTION
3.1 EXAMINATION
A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.
B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.
C. Verify that wood blocking, curbs and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.
   1. Verify that wood nailer strips are located perpendicular to roof slope and are spaced according to requirements of roofing system manufacturer.
D. Verify that flatness and fastening of metal roof decks comply with installation tolerances specified in Division 5 Section "Steel Deck."
E. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane.
F. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. The Roofing Contractor shall seal all fresh air intakes on the roof and in the areas of the disposal chute during construction. The Roofing Contractor shall notify the Architect prior to sealing fresh air intakes.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install modified bituminous membrane roofing system according to roofing system manufacturer's written instructions and applicable recommendations of NRCA/ARMA's "Quality Control Recommendations for Polymer Modified Bitumen Roofing."

B. Demolition and construction shall take place in areas only large enough to be rendered watertight on the day they are started. Phased application of roofing materials is not permitted. Each component and detail must be installed promptly on each section.

C. The Owner may require the start of the project at a location of special sensitivity. The Roofing Contractor shall make every effort to accommodate the Owner.

D. Start installation of modified bituminous membrane roofing in presence of roofing system manufacturer's technical personnel.

E. Shingling Plies: Install modified bituminous membrane roofing system with ply sheets shingled uniformly to achieve required number of membrane plies throughout. Shingle in direction to shed water.

1. Where roof slope exceeds ½ inch per 12 inches, run sheets of modified bituminous membrane roofing parallel with slope. Backnail top ends of sheets to nailer strips.

F. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of modified bituminous membrane roofing system with vertical surfaces or angle changes greater than 45 degrees.

G. Cooperate with inspecting and testing agencies engaged or required to perform services for installing modified bituminous membrane roofing system.

H. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

1. Provide cutoffs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

I. Asphalt Heating: Heat roofing asphalt and apply within plus or minus 25 deg F of equiviscous temperature, unless otherwise required by roofing system manufacturer. Do
not raise roofing asphalt temperature above the equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F of flash point. Discard roofing asphalt maintained at a temperature exceeding 500 deg F for more than 4 hours. Keep kettle lid closed, unless adding roofing asphalt.

1. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. If mopping is applied directly to substrate, tape substrate joints.

J. Safety is of major importance when heat welding or torching modified bitumens. It is the sole responsibility of the Roofing Contractor to enforce fire safety precautions at all times. Torches should be extinguished when not in use and should not be left unattended. There should be a sufficient number of fire extinguishers on the roof at all times to handle any contingency which might develop. The roofing applicators shall be trained in the proper use of fire extinguishers. The Roofing Contractor shall notify the Architect when torch work is to be done. No torch work shall be conducted one (1) hour prior to the end of the day's work.

K. The Roofing Contractor shall maintain a copy of the drawings, specifications, and the roofing manufacturer's specifications at the job site at all times.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roofing insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.

D. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

F. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring of drain.

G. Nailer Strips: Where roof slopes are greater than ½ inch per 12 inches, mechanically fasten to deck 4-inch nominal-wide, wood nailer strips of same thickness as insulation, spaced not more than 20 to 21 feet apart. Run nailers perpendicular to slope of roof.

H. Install insulation with long joints of insulation in continuous straight lines with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ¼ inch with insulation.

1. Cut and fit insulation within ¼ inch of nailers, projections and penetrations.
I. Attached Insulation, Concrete Deck: Prime surface of concrete deck with asphalt primer at a rate of ¾ gal./100 sq. ft., unless a greater weight is required by roofing system manufacturer, and allow primer to dry. Set each layer of insulation in a solid mopping of hot roofing asphalt.

J. Attached Insulation, Metal Deck: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roofing insulation to deck type indicated.

1. Fasten insulation according to the insulation and roofing system manufacturers' written instructions to meet specified wind-uplift requirements, but not less than 1 fastener for each 4 sq. ft. and at least 2 fasteners per board.

K. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and fasten to roof deck according to roofing systems manufacturer's written instructions.

L. The roof deck is designed to provide a positive slope to the drains. If during the course of the work the Roofing Contractor discovers that the deck will not provide positive drainage, a method of correction shall be submitted by the Roofing Contractor and approved by the Architect. The corrections shall be made by the Roofing Contractor at a cost to the University by change order.

M. If, after completion of the work, it is discovered that the deck will not provide positive drainage, a method of correction shall be submitted by the Roofing Contractor and approved by the Architect. The corrections shall be made by the Roofing Contractor at no cost to the University.

3.5 ROOF MEMBRANE INSTALLATION

A. General: Install modified bituminous membrane over area to receive roofing, according to manufacturer's written instructions. Extend modified bituminous membrane over and terminate beyond cants.

1. Unroll sheet and allow it to relax for the minimum time period required by manufacturer.

B. Two-ply, Modified Bituminous Membrane: Install 2 plies of modified bituminous membrane, consisting of a base ply and a finish ply, starting at low point of roofing system.

1. Base- and Finish-Ply Application: Adhere each ply to substrate in a solid mopping of hot roofing asphalt applied at rate required by roofing system manufacturer.

2. Base- and Finish-Ply Application: Adhere each ply to substrate in cold adhesive, applied within temperature range and at rate required by roofing system manufacturer.

C. Laps: Accurately align sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Heat-weld side and end laps and completely seal by rolling, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.

2. Apply granules, while asphalt is hot, to cover asphalt bead extruded at laps.
D. Install modified bituminous membranes with side laps shingled with slope of roof deck where possible.

1. Install modified bituminous membranes with side laps shingled in direction to shed water on each large area of roofing, where slope exceeds ½ inch per 12 inches.

E. Care should be taken not to overheat membrane causing damage. Repair of damaged areas shall follow manufacturer's recommendations.

3.6 FLASHING AND STRIPPING INSTALLATION

A. Install modified bituminous membrane base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. All metal components to be primed and allowed to completely dry with primer as required by roofing system manufacturer prior to installation of flashing and/or roofing membrane.
2. Prime substrates with asphalt primer if required by roofing system manufacturer.
4. Backer Sheet Application: Install base-sheet backer and adhere to substrate in cold adhesive, applied within temperature range and at rate required by roofing system manufacturer.
6. Base Flashing shall be installed by heat welding. Install in pieces full width of roll by the height required from the top to eight (8") inches out onto the surface.

B. Extend base flashing up the wall a minimum of 8 inches above roof membrane and 4 inches onto field of roof membrane.

C. Mechanically fasten top of modified bituminous membrane base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing.

D. Install modified bituminous stripping where metal flanges and edgings are set on membrane roofing, according to roofing system manufacturer's written instructions.


3.7 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect and Owner 48 hours in advance of the date and time of inspection.

3.8 PROTECTING AND CLEANING
A. Protect modified bituminous membrane roofing from damage and wear during remainder of construction period. Storage of roofing materials, tools, equipment, and debris and construction traffic will not be allowed on completed sections of roof. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove modified bituminous roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair base flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <NAME> of <ADDRESS>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner:
2. Address:
3. Building Name/Type:
4. Address:
5. Area of Work:
6. Acceptance Date:
7. Warranty Period:
8. Expiration Date:

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leads and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
   a. lightning;
   b. peak gust wind speed exceeding 70 mph;
   c. fire;
   d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. vapor condensation on bottom of roofing; and
Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof has been paid by Owner or by another responsible party so designated.

3. The Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.

4. During Warranty Period, if work has been damaged by any of the foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof has been paid by Owner or by another responsible party so designated.

5. The Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.

6. The Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <DAY> day of <MONTH>, 12<YEAR>.

1. Authorized Signature:
2. Name:
3. Title:

END OF SECTION 07551
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