

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

Effective September 1, 2015							
Revision Date							
ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
Division 0		BIDDING, CONTRACTING & GENERAL CONDITIONS REQUIREMENTS					
		00 01 01	Project	Project Title Page	Project name and other General Information		
		00 01 05	Certifications	Project Certifications Page	Professional Certifications by design professionals		
		00 01 07	Seals	Project Seals Page	Professional seals by design professionals		
		00 01 07	Contents	Table of Contents	List of components of project manual		
		00 10 00	Drawings	List of Drawing Sheets	Complete List of Drawings in contract set with Drawing No., description and date		
		00 11 00	Procurement	Bid Form	Provided by Illinois State University		
		00 43 00	Labor Requirements	Terms for On Campus Labor	Provided by Illinois State University		
		00 61 00	Performance Bond	Performance Bond Letter	Provided by Illinois State University		
		00 52 00	Agreement	Construction Agreement	Provided by Illinois State University		
		00 62 00	Certificate of Insurance	Certificate of Insurance Form	Requirements provided by Illinois State University		
Division 1		GENERAL REQUIREMENTS					
		01 10 00	General Requirements		All Division 1 Sections to be provided by Illinois State University for inclusion in all Project Manuals. Modification by exception only and only after approval by Illinois State University.		
		01 40 00	Asbestos Survey and Abatement		Provided under separate contract as part of same project by Illinois State University		
		01 42 19	Reference Standards		Illinois State University prohibits the use of building products outlined in Perkins + Will precautionary list at http://transparency.perkinswill.com . The Precautionary List includes substances commonly found in the built environment that have been classified aby regulatory entities as being harmful to the health of humans and/or the environment.		
		01 56 39	Tree Protection		A mandatory site walk-through with the Illinois State University project manager, Illinois State University arborist or Grounds Services representative, and the construction site supervisor shall take place to clarify and discuss site limitations, expectations of tree protection and concerns regarding any woody ornamentals prior to the beginning of any construction. Protection will include durable fencing and other measures to restrict access to the root zone of trees and plants during construction activities.		
				Tree Damage Penalties	Damage to campus woody plants shall include any of the "prohibited practices" as determined by Illinois State University arborist. Arborist shall evaluate damage and establish fines up to 100% of the value (see below) regardless of the current disposition of the plant.		
					1 - 3" caliper \$120.00/inch		
					3 -6" DBH \$180.00/inch		
					6 - 9"DBH \$240.00/inch		
					9 -12"DBH \$300.00/inch		
					12-15"DBH \$420.00/inch		
					15" or more DBH \$600.00/inch		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
					Replacement for value or shrubs, vines, and perennials shall be assessed at three times the current market cost of plant material.		
				Alt. Tree Protection Measures	Shall refer to any <i>pre-arranged</i> Campus Facilities-approved variation to working within the protected zone. Alternatives will allow for flexibility of requirements where approved specific measures can be implemented in lieu of the standard protection specifications. Measures may include thinning and root pruning; fertilization, aeration, boring, hand excavation, care and supervision by the campus arborist. Alternatives would be based on the specific requirements of the plant species in question as determined by the campus arborist.		
Division 2 EXISTING CONDITIONS							
		02 06 30	Schedules for Subsurface Investigations		Include test boring logs and subsurface exploration results as applicable.		
		02 43 00	Structure Moving	Manhole/Vault Adjustment	Contractor must adjust the existing manholes/vaults as required to be flush with the finish grade, as identified on the documents and at pre-bid.		
Division 3 CONCRETE							
		03 20 00	Concrete Reinforcing	General	Avoid steel reinforcement in exterior non-structural slabs-on-grade. Use fiber mesh reinforcing.		
				Concrete Sidewalk Reinforcing	Sidewalks shall be built of 4,000 psi fiber mesh reinforced concrete to dimensions and at locations shown on the drawings.	1. Fibermesh, Fibermesh Co. Div. Synthetic Inc. Inc. 2. Forta CR, Forta Corp. 3. Grace Fibers, W.R. Grace & Co.	
				Curbs and Gutters Reinforcing	Reinforcing materials shall be fiber reinforcement of polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116 Type III.	1. Fibermesh, Fibermesh Co. Div. Synthetic Inc. Inc. 2. Forta CR, Forta Corp. 3. Grace Fibers, W.R. Grace & Co.	
		03 39 00	Curing Materials		Polyethylene Film shall conform to ASTM D. Liquid Membrane Curing Compounds shall conform to ASTM C 309, Type I for all concrete surfaces.	1. W.R. Grace – Horn Clear Seal 2. Sonneborn – Kure-N-Seal 3. Toch Brothers – Acri-Seal "S"	
Division 4 MASONRY							
		04 21 00	Masonry	Face Brick	Modular Face Brick - 2-1/4" x 3-5/8" x 7-5/8", to compliment existing/surrounding buildings. Utility Face Brick – 3-5/8" x 3-5/8" x 11- 5/8", to compliment existing/surrounding buildings		
		04 22 00	Concrete Masonry Units		Size – manufacturer's standard units with nominal face dimension long x 8" high (15-5/8" x 7-5/8" actual), unless otherwise shown.		
		04 43 00	Stone	Stone Facing	Limestone is the preferred exterior facing material for buildings. Stone shall generally match the color and texture of that used in existing buildings on campus. Precast concrete may be an acceptable alternate to limestone.		
Division 5 METALS							
		05 10 00	Structural Steel		Structural steel shall conform to AISC "Specifications for Design, Fabrication, and Erection of Structural Steel Buildings."		
		05 40 00	Framing Steel		All light gauge steel framing shall conform to "Specifications for Design of Cold Formed Steel Structural Members."		
		05 51 00	Metal Fabrications-Stairs		Where treads are to be steel, they shall have a non-slip surface. Where pan type treads to receive terrazzo or other fill materials (such as concrete) are used, provide slip-resistant nosing's or abrasive surface.		
		05 58 19	Metal Fabrications-HVAC Screens		Provide bird screens mounted on the exterior face of louvers to avoid bird nesting.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

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Division 6		WOOD AND PLASTICS					
		06 14 00	Rough Carpentry	Treated Wood	Provide for pressurized preservative treatment for wood in contact with concrete for roof blocking and where moisture may occur. Design to avoid contact with roofing asphalt or tar.		
		06 41 13	Architectural Wood Casework	Veneers	Mill work shall conform to Architectural Woodwork Institute (AWI) "Quality Standards." Finish hardwood veneers shall be specified by species and cut and matching of grain.		
		06 20 00	Finish Carpentry	General	Plywood is preferred to particle board in most areas.		
		06 41 93	Cabinet Hardware		Prefer 5 knuckle institutional type hinges for full overlay doors.		
Division 7		THERMAL AND MOISTURE PROTECTION					
		07 00 00	Thermal and Moisture Protection	Recycling	Contractor shall endeavor to recycle that roofing material which is suitable for recycling during re-roofing projects. Contractors shall utilize the practices or services of companies that provide such.		
		07 22 00	Roof Insulation		<p>Polyisocyanurate foam insulation board with glass mat facer laminated to both sides of board. Insulation boards shall have a minimum density of 25 psi for the first layer (bottom) complying with ASTM C1289-01, Type II, Class 1, Grade 3 and 25 psi complying with ASTM C1289, Type II, Class 1, Grade 3 for the second layer (top). Provide a 1/2" thick thermal board consisting of either a pre-primed glass mat faced gypsum or non-primed fiber reinforced gypsum panel board over top layer of insulation</p> <p>The designer should call for a guarantee by the contractor of at least two (2) years plus 15-year total system manufacturer's warranty. The guarantee shall cover all elements of the project and stipulate that the contractor will be on the job within twenty-four (24) hours to make repairs to reported leaks. In high-rise buildings, over six stories, the University requires the highest wind uplift rating possible. Warranty for shingle roofs shall be 40 years.</p>	Roof insulation shall be manufactured or approved by the membrane roofing system manufacturer as a suitable substrate for the membrane roofing and included in the total systems warranty.	
				Warranties			
		07 31 13	Asphalt Shingles		Three dimensional, fiberglass, laminated strip shingle (5 tab), mineral surface, self-sealing	<ol style="list-style-type: none"> 1. IKO (Cambridge 40) 2. Owens Corning (Oakridge 40) 3. Certain Teed (Landmark 40) 	
		07 53 23	EPDM Membrane		EPDM single ply membrane systems, .060" fire rated, fully adhered	<ol style="list-style-type: none"> 1. Carlisle SynTech - Sure-Seal 2. Firestone Products - Rubbergard 3. Johns Manville 4. Versico 	
		07 54 23	TPO Membrane		TPO single ply thermoplastic membrane systems, .060" fully adhered	<ol style="list-style-type: none"> 1. Carlisle SynTech - Sure-Seal 2. Firestone Products - Rubbergard 3. Johns Manville 4. Versico 	
		07 60 00	Flashing	Locations	Provide flashing pans under all above grade showers. Provide flashings for all openings in exterior walls. Provide flashings for all roof drains, floor drains, scupper. Provide flashings and sleeves, 2" above floor, for all openings in laboratory and kitchen floors.		
		07 62 00	Metal Flashing		Metal roof flashings, where required, shall be copper. All metal flashings shall be designed for thermal expansion with weather tight joints.		
		07 65 23	Rubber Sheet Flashing		Provide .060 mil EPDM base flashing system as manufactured by the respective roofing system manufacturer. Utilize EPDM flashing material to the greatest extent as allowed by the system manufacturer.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

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		07 72 46	Roof Pads		Roof pads should be used around all roof top mechanical equipment and along pedestrian traffic paths. Use same roof pad as roof manufacturer.	1. Carlisle SynTech - Sure-Seal 2. Firestone Products - Rubbergard 3. Johns Manville 4. Versico	
		07 92 13	Sealants	General	Sealants, exterior and interior, one component or two component urethane, non-sag, gun grade elastomeric sealant. Use all joints one-inch wide or less wherever movement may occur on interior or exterior, at construction and expansion joints, masonry to masonry, concrete building construction joints, metal door and window frames to masonry, metal to metal and sheet metal to masonry.		
				Interior	Interior sealants	1. Sonolastic 2. Sika 3. Tremco	
				Exterior	Exterior sealants	1. Sonolastic 2. Sika 3. Tremco	
Division 8 OPENINGS							
		08 11 13	Doors and Frames	Entry Doors	All metal frames shall be 16 gauge, reinforced for all hardware and shall receive field coat of asphaltic paint on all interior surfaces prior to installation. Slush all metal frames solid with mortar or plaster. All metal doors shall be 16 gauge, insulated, reinforced and prepared for finish hardware.	1. Kawneer 2. Steelcraft 3. Vistawall	
					All exterior door locations shall include conduit for future installation of electronic security system. Conduit should extend from exterior doors to the facility's central telecommunications location. Use tracer wire above all direct buried non-metallic piping.		
		08 31 16	Access Panels	General	Access panels for electrical, plumbing and heating plant shall be a minimum of 24" X 24" opening and fire rated where needed.		
				HVAC Equipment Access	Access doors, when required, shall never be smaller than 16"x16" unless limited by equipment dimensions or duct size		
		08 71 00	Door Hardware	Mortise Lockset		1. Best Lock Co. (30H Series), with style 14 lever handles 2. Yale 8700 Series, with JN lever handles 3. Corbin Russwin.	
				Cylindrical Lockset	Lever handle style PB	1. Best Lock Co., series 93K 2. Oak (ICL cylindrical) 3. Yale, series 5400LN	
				Cores	Provided by Owner	Best, 7-pin	
				Exit devices	To be rim set with removable mullions in center for double doors; integrate with locks	1. Von Duprin, Series 33/99, with lever handle style #17 2. Hess 3. Rofu	
				Closers		1. Norton Door Controls (7500 Series) 2. Sargent Manufacturing Co. (350 Series) 3. LCN (4041/1371 Series)	
		08 74 13	Access System			Hirsch. To be provided by Illinois State University	
		08 78 00	Electronic Strikes		All exterior door locations shall include conduit for future installation of electronic security system. Conduit should extend from exterior doors to the facility's central telecommunications location	1. Von Duprin 2. Hess 3. Rofu	
		08 81 00	Glazing	Float Wire Glass	1/4" polished, Type III, Kind A, Form 1, clear, polished both faces	1. Georgian/Pilkington Sales Ltd. 2. Polished Baroque/Hordis Brothers, Inc. 3.	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

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				Clear Float Glass		1. Viracon 2. A.F.G. Industries 3. P.P.G. Industries, Inc.	
				Tempered Safety Glass	¼" thick tempered clear float safety glass meeting requirements of Safety Standard for Architectural Glazing Materials; 42 CFR 1428; 16 CFR Part 201	1. Viracon 2. A.F.G. Industries 3. P.P.G. Industries, Inc.	
		08 83 13	Mirrors		In restrooms, one large mirror is preferred over small individual mirrors over lavatories.		
		08 91 00	Louvers	Fresh air intake	Minimum 4" deep extruded aluminum drainable blade, Kynar 70, 2 coat finish, birdscreen (insect were required). Insulated blank-off panels to minimum 1" thick sandwich panel	1. Ruskin 2. Greenheck 3. Airolite	
Division 9 FINISHES							
		09 21 16	Gypsum Board	Normal use	VHI Abuse-Resistant Gypsum Board shall be used to Finished Floor + 8' in corridors, classrooms and public high traffic areas.		
				Heavy use	Abuse and Water Resistant Gypsum Board to be used in areas where moisture may be an issue.		
		09 30 13	Quarry Tile		For heavy duty traffic areas, including toilet rooms.		
				Grout	Grout shall be dark		
				Slip Resistance	The slip resistance requirements for floor tile installation are those recommended by the Americans with Disabilities Act, "Accessibility Guidelines for Buildings" (ADAAG). The static coefficients of friction (COF) recommended are 0.6 for level floors and 0.8 for ramped surfaces.		
		09 30 16	Ceramic Tile		For toilet room floors and walls.		
				Grout	Grout shall be dark		
				Slip Resistance	The slip resistance requirements for floor tile installation are those recommended by the Americans with Disabilities Act, "Accessibility Guidelines for Buildings" (ADAAG). The static coefficients of friction (COF) recommended are 0.6 for level floors and 0.8 for ramped surfaces.		
		09 53 00	Ceilings	Acoustical Ceiling Assembly	Acoustical ceilings shall consist of panels with a minimum size of 2'x2'x5/8" thick. Tiles shall be smooth vinyl or mylar-faced in high moisture locations. Tiles shall be installed with no less than one-half tile width at perimeters. Spline ceilings are prohibited.		
		09 65 13	Resilient Base	Rubber Base	Rubber, 1/8 thick, coved base, 4" high typical (replace all base with like in kind).	1. Johnsonite 2. Roppe 3. Flexco	
		09 65 16	Resilient Sheet Vinyl Flooring		Sheet vinyl is only recommended for labs, food service, or other areas where floor moisture is a major problem. It is not recommended for corridors or other public spaces.	1. Armstrong 2. Mohawk 3.	
		09 65 19	Resilient Vinyl Tile Flooring		Resilient tile is most commonly used for floor surfacing. This should be a vinyl composition tile or luxury vinyl tile.	1. Armstrong 2. Mohawk 3.	
		09 66 00	Terrazzo	Terrazzo Flooring	Floors where heavy traffic is expected (lobbies and student corridors and stairs) should be finished with terrazzo surfaces. Patch existing terrazzo with the use of transition strips between the existing and new installation. Terrazzo used in public areas shall have a non-slip aggregate or finish.		
		09 68 00	Carpet	Regular Use - Broad Loom or Tile	Solution dyed. Tufted, woven, textured loop construction. 1/10 min. gauge/stitch.	1. Mannington 2. Lees 3. Mohawk	
				Warranty	10 year		
				Heavy Use - Broad Loom or Tile	Solution dyed. Tufted, woven, textured loop construction. 1/10 min. gauge/stitch.	1. Mannington 2. Lees 3. Mohawk	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

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				Warranty	25 year Broad Loom. 15 Year Tile		
		09 72 16	Wall Covering	Vinyl Wall Covering	Vinyl or fabric wall coverings are not recommended but, commercial grade wall coverings may be used in special areas with prior approval		
		09 90 00	Paint	General	All VOC products shall conform to the Federal guidelines for VOC paints.		
				Walls / Ceiling	Low Lustre latex enamel is the standard for all walls. Low luster white or flat is the same for ceilings. Hallways and other public access areas shall have low luster-eggshell or semi- gloss latex enamel for walls. Restrooms shall have low luster or equal latex enamel finish on walls and ceilings.	1. MAB 2. Pratt and Lambert 3. Benjamin Moore 4. Sherwin Williams	
				Steel Doors	Steel door and door frames shall be factory primed. If gray primer is used, finish with two coats of low luster, oil based enamel. If primer is other than gray, finish with three coats of low luster, oil based enamel. Tops and bottoms must be sealed. In some circumstances DTM or latex epoxy can be used on metal doors and frames.		
		09 93 23	Interior Staining and Finishing	Wood Doors	Wood doors shall first be stained, followed by a sanding sealer and two coats of satin or gloss poly-urethane varnish. Avoid high gloss varnishes. Tops and bottoms must be sealed.	Varnish: Products same as paints Stains: 1. Richlux 2. Pratt & Lambert 3. Sherwin- Williams	
		09 96 43	Fire Retardant Coatings	Electrical/Telephone Backboard	Paint with one coat #200 primer, one coat 20 /20 fire retardant, one coat 40 /40 fire retardant		
		09 97 00	Special Coatings (Color)	Piping	All piping, when painted, shall be painted according to the following schedule: Air - Dark Green Chilled Water - Black Condensate - Brown Domestic Cold Water - Green Domestic Hot Water - Light Blue Gas - Yellow High Pressure Steam - Red Medium Pressure Steam - Purple Low Pressure Steam - Orange Hot Water - Heating - Blue Steam Exchange - Pink Tower Water and Drains - Gray Soft Water - White		
Division 10 SPECIALTIES							
		10 11 16	Marker Boards		Classroom marker boards to be 5' high if possible and mounted at 30" aff. If 4' high marker boards must be used, mounting height to be 36" aff. Marker boards should also be installed to allow maximum usage while projector screens are in a lowered position. Ceramic steel marker boards with lifetime warranty are preferred in all locations.		
		10 14 00	Signage	Interior Signage	Interior graphics should assist first time users. There should be clarity so that spaces are easy to use and understand and visitors feel welcome.	1. Kroy 2. Inneface 3. Takeform 4. ASI	
				Exterior Signage	Install exterior sign near primary entrance or pathway in permanent fashion as directed by the Owner. (See Appendix)		
		10 21 13 13	Stainless Steel Toilet Compartments		Mount all partitions from the ceiling or wall. Do not mount on floor. Provide appropriate structural reinforcement as needed.	1. Accurate Partitions Corp. 2. Capitol Partitions, Inc. 3. Global Steel Products Corp.	
		10 21 13 19	Solid Plastic/High Density Polyethylene Toilet Compartments		Mount all partitions from the ceiling or wall. Do not mount on floor. Provide appropriate structural reinforcement as needed.	1. General Partitions Manf. Corp. 2. Hadrian 3. Santana	
		10 28 13	Toilet Accessories	Diaper Changing Station	Provide diaper changing stations in all new public restroom construction. Provide stations in all renovated public restroom construction where space allows.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

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		10 44 13	Fire Extinguisher Cabinets		Where shown on drawings, provide recessed cabinets for the extinguisher of sufficient depth to suit the style of trim designated by the engineer. Locked cabinets shall be requested in most areas.	1. JL Industries 2. Larson's Manufacturing 3. Kidde	
		10 44 16	Portable Fire Extinguishers		Provide fire extinguishers of type "ABC", "K", or "D" according to the space usage and the latest NFPA 10 standard for Portable Fire Extinguishers. "ABC" type extinguishers shall be UL rating: 4-A: 60-B:C. Construction shall include steel shell, brass valve, and stainless steel handles.	1. Amerex 2. Ansul 3. Badger	
Division 11		EQUIPMENT					
		11 53 13	Laboratory Equipment	Fume Hoods	Exhausting of all fumes shall be arranged to avoid fresh air intakes of all systems. Power exhaust with nozzles as required. Exhaust design shall include a review of the existing or planned building HVAC system. For new exhaust equipment or exhaust system changes, balancing of existing HVAC equipment will be included to avoid creating negative air pressure in the exhausted areas. New HVAC equipment will be included in the project if required to maintain an acceptable air flow balance.		
Division 12		FURNISHINGS					
		12 21 13.13	Metal Horizontal Blinds		Type I- 1" Mini Horizontal Aluminum Blinds	1. Hunter Douglas 2. Bali 3. Levolor	
					Type II- 2" Horizontal Aluminum Blinds	1. Hunter Douglas 2. Bali 3. Levolor	
		12 24 23	Roll-Down Blinds		Type III- Roller Shades, 1% Openness for Classrooms or 5% Openness for Offices, with valance and sealed pocket hem bar.	1. Hunter Douglas 2. Draper 3. Mechoshade	
		12 59 00	Systems Furniture	General	Furnishings are generally procured and installed by Illinois State University, but must be accommodated within the design by the architect.		
				Power and Data Connections	Tables may be fixed or movable depending on how power or data connections are to be handled. Clearly describe the method of delivering power and data to tables and the distribution details involved. Clearly describe the method of delivering power and data to panel systems that integrate power and data.		
Division 13		SPECIAL CONSTRUCTION					
		13 26 00	Custodial Requirements	Custodial Closets	Each floor should be equipped with at least one centrally located custodial room, which should contain a utility floor sink (20" x 32" with depth of at least 6"), and be large enough to accommodate a custodial cart (26" x 46") and other frequently used equipment. Recommended room size is 8' x 12'; but no smaller than 6 ft. x 7 ft., with 10 ft. ceiling. Provide hot and cold water fixture with hose attachment.		
Division 14		CONVEYING SYSTEMS					
		14 20 00	Elevators	General	Any controls that are proprietary in nature, where the manufacturer does not provide training to any other vendor or where full documentation of the wiring, logic and other system information can not be provided to the owner by company policy shall be expressly prohibited in the specifications		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

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				Features	Design and selection of geared traction, gearless traction, plunger hydraulic, or holeless hydraulic elevators shall be determined by both anticipated usage and analysis of circulation patterns within the building as well as comparison of estimated equipment costs. Machine room less (MRL) products will not be considered as a primary selection but may be considered on a case by case basis only as an alternate option if approved by AHJ and installation does not require a code variance. If the outcome of the elevating analysis determines that a building requires two elevators, at least one of the two shall be designed as a "service" elevator with a minimum 4,000 pound capacity capable of carrying passengers as well as freight on occasion. The passenger elevator capacity shall be a minimum of 3,500 pounds and the speed of travel shall be determined by the elevator analysis studies. At a minimum the platform size(s) shall meet ADA access requirements and shall provide the capability of carrying a medical stretcher. As specified by the manufacturer, the temperature and humidity control requirements within both the elevator machine room and hoistway shall be made clear to all parties concerned during the elevating analysis and design phases of the project. As per code, elevators shall be equipped with line-powered emergency phones according to current ADA requirements and shall be capable of operating over both University digital phone and VoIP systems.		
				Warranty	As per manufacturer's warranty requirements, the Contractor shall provide monthly maintenance service for a period of 24 months, commencing on the date of the signing of substantial completion. Service shall consist of once a month examinations at approximately 30 day intervals, with notice to the Owner prior to each examination, and repair/replace defective parts at that time. The contractor will provide the University with specific details of what service work will not be covered under the terms of the manufacturer's warranty and what the contractor's standard hourly rate and overtime rate will be during the 24-month warranty period.		
				Service Calls	The Contractor shall respond to all call backs during the warranty period 24 hours per day, seven (7) days a week, including all Holidays, within two hours time of being notified of the call at no additional cost to the University. Contractor will respond to entrapment calls within 30 minutes.		
				Maintenance Program	As required by code, the contractor shall provide a detailed Maintenance Control Program (MCP) and follow-up with record keeping outlining what and when the entire elevator system and all components are to be examined, lubricated, adjusted, repaired, replaced, tested on a monthly basis including the required test of the fire service recall function. The contractor shall maintain the elevator machine rooms, hoistways and pits in a clean and safe condition and notify the University of any conditions requiring attention. All manuals, shop drawings, wiring and single line diagrams, and diagnostic tools and equipment necessary to set up, adjust or troubleshoot the system shall be provided to the University for each elevator installed. It is anticipated that any new installation (or renovated existing installation) at the University will be capable of providing at least 25 years of dependable service to the University before any major renovation is necessary again assuming that a quality full maintenance program remains in effect throughout the entire life of the equipment. Maintainability requirements shall include the ability to procure all proper replacement parts as well as any required troubleshooting or diagnostic tools necessary for maintenance or repair work to be completed by qualified, licensed and industry trained elevator mechanics.		
		14 21 00	Traction Elevators			1. Schindler 2. Otis 3. Thyssen Krupp 4. Kone	
		14 24 00	Hydraulic Elevators			1. Schindler 2. Otis 3. Thyssen Krupp 4. Kone	
				Hydraulic Jacks		1. CEMCO 2. ESCO 3. EECO 4. DL Martin	
				Hydraulic Valve		1. Maxton 2. ESCO 3.	

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Design Construction Standards
Based on CSI 49 Division Format**

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		14 26 00	Restricted Access		Any designated restricted access floor call buttons shall be key-operated switches compatible with the University standard Best Lock Corporation cores and cylinders.		
		14 27 13	Finishes		All car ceilings proposed and selected by owner shall be suspended aluminum frames with either translucent or opaque panels with energy-efficient fluorescent or LED light fixtures and shall meet all applicable codes. K. All car flooring materials proposed and selected by owner shall be designed for high-traffic embossed rubber tiles or sheet goods installed with epoxy-based adhesives.		
		14 28 16	Elevator Controls			1. G.A.L 2. Motion Control 3.	
Division 15		Reserved					
Division 16		Reserved					
Division 17		Reserved					
Division 18		Reserved					
Division 19		Reserved					
Division 20		Reserved					
Division 21		FIRE SUPPRESSION					
		21 00 00	Fire Suppression	General	Victaulic piping systems are allowed. Polybutylene may be used when in conformance with the Illinois State Fire Prevention and Building Code.		
		21 11 16	Hydrants		Hydrants with 5" or 5½" valves. Hydrants shall be ordered with threads that match Town of Normal construction standards. Hydrants shall have two 2½" national standard thread hose connection and one 4" national standard thread 6" pumper connection.		
		21 12 00	Standpipe Station Cabinets		Specify a 2½" national standard thread. The local fire department will use this for their hoses.		
		21 23 00	Fixed Wet Chemical Extinguishing Systems (Restaurant Systems)		Provide fixed wet chemical extinguishing systems (restaurant systems) according to the latest NFPA17A and NFPA 96.		
		21 30 00	Fire Pumps	Electrical Service	The fire pump electric service shall be connected ahead of the building main secondary circuit breaker using either a tap off the switchgear line side bus or a tap directly off of the transformer secondary bushings. A line side tap is not required if the fire pump has emergency power backup.		
				Emergency Generator Service	If the building has an emergency generator, the generator shall be connected to the fire pump via a transfer switch in the fire pump controller. The generator shall start upon loss of voltage at the fire pump transfer switch. If the building has a double-ended secondary system, the fire pump controller shall be connected ahead of both main breakers using the above methods and a transfer switch in the fire pump controller. If an emergency generator is used to provide backup power for the pump, connection to one of the normal sources and the emergency generator is sufficient.		
Division 22		PLUMBING					
		22 00 00	Plumbing	General	All work shall conform to the Illinois Plumbing Code (77 Illinois Admin. Code, Part 890), the Town of Normal regulations concerning water and sewer services and plumbing (Town of Normal Municipal Code, Chapters 7 and 12), regulations of the Bloomington and Normal Water Reclamation District, the Illinois EPA and other lawful governing bodies as well as these guidelines specific to Illinois State University.		

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Design Construction Standards
Based on CSI 49 Division Format**

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		22 05 13	Motor Requirements for Plumbing Equipment	Motors	Motors below 1/2 HP shall be 120/1/60. Motors 1/2 HP and above shall be 200/3/60 or 208/3/60, 230/3/60 or 240/4/60, or 480/4/60 or 480/3/60 volt systems, 208/230 volt dual range motors are not preferred. Motors shall be of the high efficiency, high power factor type for minimum life cycle costs. Motors 2 HP and above shall be of cast iron end bell construction.	1. GE 2. Toshiba 3. Reliance 4. Marathon 5. Baldor	
				Motor Starters		1. SquareD 2. AB 3. Cutler-Hammer 4. GE 5. Toshiba	
		22 05 23	Valves	General	Unless otherwise noted, all valves for shut-off service shall be gate, globe or ball valves, Bypass valves to be globe. For domestic water systems, use ball valves up to 4"; larger size piping requires gate valves, except for main water shut off by water meter use 6" ball valves.		
				Valves, Ball	Body: Bronze, cast iron, stainless steel Body Style: Standard Port Trim: 316 Stainless Steel Ball and Stem Seat: Reinforced Teflon (RTFE), 15% glass filled double seal Seat Working P/T Rating: 200 psig @ 250°F Minimum Body Working P/T Rating: 200 psig @300°F Minimum WOG Rating: 200 psig Minimum Saturate Steam Rating: 125 psig Minimum	1. Milwaukee 2. Stockham 3. Nebcoc 4. Sharpe 5. Apollo 6. American 4000 series	
				Balancing Valves, Water		1. Armstrong 2. B&G 3. Wheatley	
				Check Valves	2" and under – swing check, screwed end. 2. 2½ " and over – non slam type globe styled lift check, tilting disc or wafer body non-slam type lift check. Double disc or bi-folding disc type valves are not acceptable.		
				Gauge Valves	Provide needle valves for shut-off on all pressure gauges at the gauge and separate ½" ball valves for the various taps to the gauge on a manifold gauge.		
				Control Valves	Control shall be DDC controlled, not pneumatic. Retrofits may incorporate DDC actuators on existing valves.	1. Belimo 2. Siemens 3. Johnson Controls.	
				Mixing Valves	Shall be constructed to be easily maintained and resistant to harsh water conditions. Must be metallic construction. Mixing valves shall have shut off valves in addition to the manufacturer supplied stops in the mixing valve assembly	1. Leonard 2. Bradley 3. Powers 4. Cash Acme	
				Water Valves, Underground		1. Clow C405 2. 3.	
		22 05 29	Plumbing Drains & Supports			1. Wade 2. Zum 3. Josam	
		22 05 76	Cleanouts		Shall be same size as the pipe or as required for testing and access. Cleanouts shall consist of proper drainage fitting at main and terminated with ferrule and brass screw plug. Interior cleanouts located in the floor shall be adjustable type with a finish compatible with the type of floor surface: cleanouts in walls shall have a chrome cover plate or be behind an access door. Exterior cleanouts shall have a heavy duty frame, cover, and interior brass plug with lead seal. Exterior cleanouts shall be set in concrete at least 4" thick and 24" square. Locate cleanouts per plumbing code. Anytime a horizontal drain line for a urinal, lav, or sink runs into a tee, double wye, or cross, a cleanout should be placed in the vertical vent, a minimum of 1" above the flood stage of the fixture.	1. Josam 2. Smith 3. Wade 4. Zum	
		22 06 10	Plumbing Schedule	Fittings and Joints	Steel 2" and below - Threaded, cast iron (except gas, use malleable iron) Steel above 2" - Welded, or Victaulic for CHW or condenser water Copper, refrigerant (45% minimum, cadmium free) - Wrought, silver solder Copper, plumbing, and compressed air - Wrought, silver solder Ductile over 12" - Mechanical, slip joints Cast iron - Above grade, bell and spigot, w/ neoprene gasket or no-hub neoprene gasket and stainless steel clamp. Below grade, bell and spigot w/ neoprene gasket.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		22 07 00	Plumbing Insulation	Plumbing Equipment	Fittings, Valves and Specialties shall be insulated with factory molded fittings of the same thickness as adjoining pipe. Flexible, custom formed and removable jackets for heating valves or specialties are acceptable. Chilled water pumps shall be enclosed in a removable insulated box that allows access to the pump with no disruption of the piping or electrical connections or with a minimum 1" 25/50 fire rated insulation. Strainer bodies shall be insulated. All or a portion of the insulation shall be removable to allow access to the strainer basket.	1. Armstrong 2. Certaineed 3. Dow 4. Owens-Corning 5. Imcoa 6. Childers 7. Rubatex.	
		22 11 13	Facility Distribution	Underground Water Service	Water Valves, Underground	1. Clow C504 2. 3.	
		22 11 16	Domestic Water		Domestic Water / Polypropylene Domestic water / Type L hard copper all sizes Buried Domestic Water / Class 52 ductile iron	1. Enfield 2. Fuseal 3.	
		22 11 19	Domestic Water Specialties	Air Gap Fittings	Shall be made to provide a fixed gap between drains which is open to atmosphere.	1. Josam 2. Smith 3. Wade 4. Zum	
				Back Flow Preventers	Locate vented backflow preventers where relief discharge spillage is not a hazard or problem; otherwise, pipe discharge to a drain.	1. Wilkins 2. Watts 3. FEBCO	
				Water Hammer Arrestors		1. Watts 2. PPP Industries 3. Sioux Chief	
				Strainers	All strainer elements shall be stainless steel, with No. 20 mesh screen. Domestic water service strainers shall be entirely non-ferrous.	1. Sarco 2. Illinois 3. Zum 4. Dunham Bush 5. Mueller	
				Vacuum Breakers	All hose bibs and other fittings with hose connections shall be complete with vacuum breakers.		
				Sillcocks	Shall be non-freeze integral vacuum breaker type. Each sillcock shall have its own isolation valve inside the building. Provide at least one sillcock on each side of the building	1. Woodford 2. Zum 3. Wade	
		22 11 23	Pumps, Water (Hot and Cold)	General		1. Aurora 2. Bell & Gossett 3. Gould 4. Grunfous	
				Hot Water Recirculating Pump	Pumps shall be pipe mounted with all bronze casting and impeller, rated for 125 psig. Control scheme shall depend on particular application.	1. Bell and Gossett 2. Grunfous 3. Taco	
				Domestic Water Booster Pump	Shall preferably be factory packaged duplex pumps with all components fully frame mounted, piped, painted and wired and tested at the factory. Complete control package shall be provided, including alarms, and connected to the building automation system. Some applications will require variable frequency drives, selected to match pump characteristics. Provide a compression tank of at least thirty gallon capacity mounted at the top of the building to minimize excessive pump cycling.	1. Aurora 2. Bell and Gossett 3. Weil 4. Taco	
		22 13 19	Grease Interceptors			1. Rockford 2. Zum 3. Wade	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		22 13 29	Sewage Ejectors	General	Sewage ejector assemblies shall consist of centrifugal volute casings, bronze impellers, long split steel pump shafts, thrust bearings, metal guide bearings, flexible couplings, float switches with copper floats, low speed motors (1750 rpm, or less), and float guide pipes. Duplex pumps shall be provided with separate electrical feeds and separate disconnects to allow servicing and repairs without interrupting pump operations. A high water float switch and alarm bell shall be furnished with each installation. The high water float switch shall send an alarm signal to the nearest BAS panel.	1. Aurora 2. Hydromatic 3. Weil 4. Zoeller	
		22 14 26 13	Roof Drains		Shall be cast iron body with flashing clamping ring and cast iron removable beehive strainer and sediment cup. Outlet to match type of pipe.	1. Josam 2. Smith 3. Wade 4. Zum	
		22 14 26 16	Floor Drains		Shall be cast iron body with cover and finish to match area in which it is being installed. Use ductile iron covers in heavy equipment use area and nickel bronze in finished areas. Floor drains in trash rooms serving kitchens shall have hanging basket type sediment bucket. Floor drains in mechanical rooms may require a heavy duty adjustable 13" square top to accept multiple equipment drains.	1. Josam 2. Smith 3. Wade 4. Zum	
		22 14 26 19	Trench Drains		Shall be modular precast polymer concrete, cast iron, or polyester fiberglass trench sections with presloped 4" wide radiused interior waterways, knockouts, endcaps, cast iron frame and slotted ductile iron grate, extra heavy duty rated, stainless steel grate holdowns.	1. Aco 2. Neenah 3. Josam 4. Zum	
		22 14 29	Sump Pumps	General	Sump pump assemblies shall consist of centrifugal volute casings, bronze impellers, long split steel pump shafts, thrust bearings, metal guide bearings, flexible couplings, float switches with copper floats, low speed motors (1750 rpm, or less), and float guide pipes. Duplex pumps shall be provided with separate electrical feeds and separate disconnects to allow servicing and repairs without interrupting pump operations. A high water float switch and alarm bell shall be furnished with each installation. The high water float switch shall send an alarm signal to the nearest BAS panel.	1. Aurora 2. Hydromatic 3. Weil 4. Zoeller	
		22 15 13	Compressed Air Piping		Compressed air service and control 3/8" and below copper tubing Fire rated polyethylene tubing in and above control panels, all other hard drawn copper Compressed air 1/2" / Type L hard copper		
		22 33 13	Point of Use Electric Water Heater		These may be considered for special circumstances. Where approved, each installation shall meet applicable plumbing and electrical codes for this jurisdiction and shall be a complete system. Installation shall include a tank with an insulated steel jacket, temperature and relief valve, drain valve, wall bracket, replaceable heating element, adjustable thermostat control, energy cut-off, on-off switch, cord with grounded plug.	1. State 2. AO Smith 3. American	
		22 34 36	High-Efficiency Commercial Gas Fired Water Heater		These may be considered for special circumstances. Where approved, each heater shall be specified as a complete system including valves, gauges, controls, etc. Attention shall be given to ease of maintenance and accessibility to critical components.	1. Aerco 2. AO Smith 3. American	
		22 35 13	Instantaneous Steam Water Heater		These are preferred and shall have a steam control element not exceeding six feet per second. All materials in contact with domestic water shall be non ferrous, type L copper, Design shall allow the entire heat exchanger to be partially or completely dismantled without removing either the potable water connectors or the heating connectors. Each module shall have a separate individually operated electric steam valve. Water heater shall be specified as a complete system, including circulating pump, temperature and pressure relief valves, steam and condensate strainers and traps, pressure gauges, water thermometers, insulated steel jacket, isolation ball valves, control package, etc.	1. Aerco 2. 3.	
		22 42 13	Water Closets and Urinals	Water Closet Seats		1. Church 2. 3.	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
				Plumbing Flush Valves		1. Sloan 2. Zurn 3. Delta	
				Non gravity stool, Wall mounted		1. Kohler 2. American Standard 3. Mansfield	
				Non gravity stool, Floor mounted		1. Kohler 2. American Standard 3. Mansfield	
				Tank type stool		1. Kohler 2. American Standard 3. Mansfield	
				Fixture Carriers	Carriers shall be adjustable, floor mounted, foot type.	1. Smith 2. Josam 3. Wade 4. Zurn	
				Urinals		1. Kohler 2. American Standard 3. Mansfield	
		22 42 16	Lavatories			1. Kohler 2. Geber 3. Mansfield	
		22 42 23	Showers	Showerheads		1. Sloan #AC-11-B-3 2. Kohler 3.	
				Shower Mixing Valves	Shall be pressure balanced to avoid scalding with changes in water system pressures. Adjustable temperature stop shall be set no higher than 110 degrees F. Shower valves which have diverters to change flow from fixed head to hand held shall be of a type that cannot shut off the flow of water to both heads at the same time	1. Symmons 2. Leonard 3. Speakman 4. Delta 5. Zurn	
		22 42 36	Mop Basins		Shall be precast terrazzo or molded stone, min. 36" x 36" x 5" with stainless steel edge protectors, 3" drain, wall mounted hot and cold mixing faucet with vacuum breaker and 3/4" hose connection. Backsplash of at least 18" tall shall be installed on the walls surrounding mop sinks.	1. Fiat 2. Mustee 3. Stern-Williams	
		22 42 39	Commercial Faucets and Trim	Lavatory Faucets	Must be commercial grade	1. American Standard 2. Chicago 3. Speakman 4. Kohler 5. Delta	
				Commercial Kitchen Faucets	Must be commercial grade	1. Chicago 2. T&S Brass 3.	
		22 46 19	Safety Showers and Eyewash Stations		Shall be located adjacent to the exit doorway of every laboratory and near each chemical treatment or mixing station in mechanical spaces. Drains shall be beneath the showers.	1. Bradley 2. Chicago 3. Speakman 4. Guardian	
		22 47 13	Water Coolers		Shall be mounted on backing boards, top and bottom with bottom anchored to the wall, ADA accessible, capable of producing eight gallons per hour at 50 degrees F.	1. Elkay 2. Halsey Taylor 3. Oasis	
		22 63 13	Laboratory Gas Piping		Natural Gas, above grade / Black Schedule 40		
		22 66 53	Laboratory Waste Piping		Acid waste / Glass, polypropylene		
		22 67 13	Laboratory Water Piping		Quality Water, RO or DI / CPVC, or PVDM, purity grade, or FRP, PVC Schedule 80		
Division 23		HEATING, VENTILATING, AIR CONDITIONING					

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		23 00 00	Heating, Ventilating, and Air-Conditioning	General	New construction and major remodeling projects shall comply with the most recent edition of the International Energy Conservation Code (IECC) for commercial buildings.		
				Static Pressure	High estimated static pressures for fans and head pressures for pumps cause larger than necessary fans, pumps, and motors which waste energy and unnecessarily increase size of electrical service. Calculate realistic static pressures without double safety factors.		
				Equipment Access	Install all piping, ductwork, conduit and accessories to permit access to equipment for maintenance, service, and replacement.		
				Restrooms	Restroom ventilation to have supply air and 100% exhaust.		
		23 01 00	Operation and Maintenance of HVAC Systems	Systems	Generally, offices and classrooms shall be conditioned by variable air volume systems with 100% economizer capability. Laboratories, animal rooms, and other areas requiring high ventilation rates shall include reheat as necessary. All systems shall have individual temperature control with cooling and heating controlled in sequence with deadband. Provide night setback with manual override when appropriate		
					Perimeter zones shall be heated by hot water radiation. All systems shall have individual room temperature control with cooling and heating controlled in sequence with a deadband.		
				Metering	Each utility shall be metered, with meters connected to the Apogee campus automation system for remote monitoring.		
		23 05 00	Common Work Results for HVAC	General	Steam system pressure ratings: The steam system is a constant (normal) pressure system of 115 psig. The system has central safety valves set at 138 psig. All pressures are measured at the tie point to the existing distribution main.		
					The consultant shall design around the following parameters: Low pressure is 25 psig or less; high pressure is above 30 psig. <u>Heating loads:</u> The 115 psig steam is reduced to working pressure steam ranging from 25 psig to 18 psig depending on the building system design. In some cases the steam is further reduced to a lower pressure, as low as 5 psi. Process loads: All process loads, such as domestic water heaters, sterilization equipment, etc., shall be designed to meet rated load with 15-20 psig of steam pressure reduced at the building. Control for such equipment shall be designed to handle the pressure variation from 0 to 60 psig, and shell tube tests of 125 psig min. PRV and control valve drops must be accounted for. For domestic hot water converters, the consultant is advised that the winter cold water temperature is 40 degrees F and 70 degrees F in the summer.		
		23 05 13	Common Motor Requirements for HVAC Equipment	Motors	Most buildings on campus are 208/3/60 or 480/3/60 guarantee motors to meet appropriate supply. Motors <1/2 hp can be 120v/1ph. Motors > 1/2 hp shall be three phase (if applicable) and premium efficiency. Motors shall meet current energy code.		
					Motors below 1/2 HP shall be 120/1/60. Motors 1/2 HP and above shall be 200/3/60 or 208/3/60, 230/3/60 or 240/4/60, or 480/4/60 or 480/3/60 volt systems, 208/230 volt dual range motors are not preferred. Motors shall be of the high efficiency, high power factor type for minimum life cycle costs. Motors 2 HP and above shall be of cast iron end bell construction. Guaranteed minimum motor efficiencies, based upon IEEE tested method 112-b, shall be listed for each motor on the project		
					For equipment expected to run more than 12 hours per day or more than 3,000 hours per year, use "premium efficiency" motors, per NEMA standard.		
					Drive enclosure shall be equipped with 120v cooling fans. Unit shall be designed to perform in environmental conditions 100 degrees Fahrenheit and 90% RH, ambient, without any loss of performance. Each drive shall include auto/off/manual switch: Manual local speed control, adjustable current limit, acceleration and deceleration rates; remote start/stop for automatic control. Fast acting, semi conductor fusing shall be included with drive.	1. GE 2. Toshiba 3. Reliance 4. Marathon 5. Baldor	
				Motor Starters		1. SquareD 2. AB 3. Cutler-Hammer 4. GE 5. Toshiba 6. Siemens	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		23 05 16	Expansion Fittings and Loops for HVAC Piping	High Pressure Steam	Externally pressured, bellows type	1. Hyspan 3500 2. 3.	
				Hot Water Service	Stainless steel, bellows type	1. Flexonics 2. Adscos 3. Hyspan 4. Mason	
				Finned Tube Expansion Compensation	Stainless bellows with shroud	1. Flexonics 2. Adscos 3. Tube Tum	
		23 05 19	Metering by Owner		Make-up water for closed systems shall be metered. Make up water shall be protected by a backflow preventer. Cooling tower make-up and blow-downs shall each be metered. Make up water shall also be protected by a backflow preventer. Tower water treatment controls shall use makeup and blow down meters to control blowdown and chemical feed.	Meters for make-up and blow-downs, where used, shall be single source supplier by Neptune, (model T10, as specified by Town of Normal) with remote reader and contact head (with E2 transmitter) connected to Apogee/Johnson Building Control System. To be provided by Illinois State University	
		23 05 19	Metering and Gauges by Contractor	Meters, Chilled Water	Make-up water for closed systems shall be metered. Make up water shall be protected by a backflow preventer. Non-resettable in GPM.	1. Sarco "ILVA" 2. Controlotron 3. Badger	
				Meters, Steam Condensate	Meters shall be sized to measure the flow with all condensate pumps operating and turndown shall be adequate to accurately measure the flow produced with only one pump against maximum discharge pressure. Meter registers shall be non-resetting (in lbs/hr) and shall be calibrated to accumulate at least six months of consumption without rolling over. Consumption units shall be "lbs" of condensate.	1. Sarco "ILVA" 2. Badger 3. Neptune,	
				Meters, Steam	Steam meters shall be capable of a minimum of 50:1 turndown due to great variation in typical steam load for campus applications. All meters must be designed for a minimum of 350 degree F operating temperature and 150 psi working pressure.	1. Sarco "ILVA" 2. Dietrich Standard 3.	
				Pressure Gauges	Pressure gauges shall be stainless steel case, non-repairable, silicone filled with 3-1/2" diameter case. Gauges shall have 3% accuracy over the appropriate range of 0-30 psi, 0-100, or 0-160. Shall be suitable for operation at 160 degrees Fahrenheit and include a shut-off cock.	1. Taylor 2. Terice 3. Weiss	
				Thermostats	Minimum 7" adjustable angle, brass stem, liquid-in glass. Choose appropriate range.	1. Taylor 2. Terice 3. Weiss	
		23 05 23	General Duty Valves	Temperature Control Valves		1. Belimo 2. Siemens 3. Honeywell 4. Danfoss	
				Thermostatic Valves, Self Contained		1. Danfoss 2. 3.	
				Triple Duty Valves		1. Bell & Gossett 2. Aurora 3.	
				Valves, Ball		1. Milwaukee 2. Stockham 3. Apollo	
				Valves, Gate		1. Milwaukee 2. Stockham 3. Apollo	
				Valves, Butterfly		1. Milwaukee 2. Stockham 3. Apollo	
		23 05 33	Heat Trace		Trace all piping in areas exposed to freezing. Termination by EC		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		23 05 48	Vibration Isolators		Properly isolate all equipment, duct and piping in noise sensitive areas. Equipment containing compressors shall be isolated. Provide engineered submittal drawings of proposed system	1. Mason 2. Vibro-acoustics 3. Flexonics 4. Kinetics	
		23 05 53	Identification of HVAC Piping and Equipment		Identify all equipment, piping and duct with easily readable labeling		
		23 05 93	Testing, Adjusting and Balancing	General	Test, balance and adjust all water and air systems within 10% of design		
				Test Plugs		1. Peterson 2. Sisco 3. Watts 4. Terrice	
				Air Outlets		1. Anemostat 2. 3.	
		23 07 13	Duct Insulation	General	All supply air and all fresh air ducts and plenums, and plenums or ducts handling a mixture of fresh air and return air shall be insulated. Fresh air inlet ducts or plenums from intake louvers to unit housings shall be insulated. Insulate all ducts in equipment rooms as well as all air conditioning fans and housings. Duct heating coils, dampers, etc., shall be considered part of the duct system and shall also be insulated. Housings containing filters, coils, and similar equipment shall be insulated. Insulation shall not interfere with access for routine maintenance. Conform to current energy code. Use rigid board with lagging on exposed ductwork where there is a fear being crushed do to servicing. Use blanket insulation on concealed duct.		
				Installation	Exposed ductwork in areas subject to minimal or no traffic shall be insulated with 1" rigid fiberglass board. Exposed ductwork, include. fans, housings and intakes, in areas of moderate or heavy traffic or contact shall be insulated as above and shall be covered with a heavy density fiberglass cloth jacket pasted in place with a washable, fire retardant synthetic resin base emulsion applied to the total surface of the fiberglass. Concealed ductwork shall be insulated with 1-1/2" thick, 3/4 lb. density flexible fiberglass blanket with factory applied vapor barrier, suitably anchored and sealed at all points.		
				Waterproof Insulation	Waterproofing jackets for ducts exposed to roof-top conditions shall be a rigid aluminum jacket formed around the insulated duct, or shall be a flexible, UV resistant material.	1. Flex-Clad 400 by MFM 2. 3.	
				Supply/Return Air	3/4# density blanket with kraft-scrim-foil vapor barrier jacket	1. Knauf 2. Certaineed 3. Manville	
				Outside air	1.5# fiberglass board with reinforced foil jacketing	1. Knauf 2. Certaineed 3. Manville	
				Relief Air	3/4# density blanket with kraft-scrim-foil vapor barrier jacket	1. Knauf 2. Certaineed 3. Manville	
				Exhaust air	None required		
				Grease duct	2 layers of high temperature wrap. Installed per manufacturers instructions. Grease duct shall be wrapped according to IMC.	1. Fyrewrap 2. 3.	
		23 07 16	HVAC Equipment Insulation		Temperatures below 60 degrees F, Temperatures 110-200 degrees F, closed cell elastomeric foam. Above 200 degrees F use calcium silicate. Provide jacketing as required	1. Knauf 2. Certaineed 3. Manville	
		23 07 19	HVAC Piping Insulation	General	Rigid fiberglass insulation is preferred on steam distribution and condensate return lines. C. Polyolefin insulation is preferred for direct burial service when temperatures do not exceed 200 degrees F.	1. Knauf 2. Certaineed 3. Manville	
				Steam Piping	Fiberglass with kraft-scrim-foil vapor barrier jacket		
				Steam Condensate Piping	Fiberglass with kraft-scrim-foil vapor barrier jacket		
				Hot Water Piping	Fiberglass with kraft-scrim-foil vapor barrier jacket		
				Chilled Water Piping	Closed cell elastomeric		
				Condensate piping	Fiberglass with kraft-scrim-foil vapor barrier jacket		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
				Valves and Fittings	Fitted, removable insulating jacket.	1. Advanced Thermal Corporation 2. 3.	
		23 08 00	Commissioning		Commission HVAC system to meet design intent		
		23 09 13 23	Sensors and Transmitters	Thermometers	All thermowells shall be stainless steel for steam service and brass for water service	1. Air Monitor 2. 3.	
				Air Flow Measurement			
		23 09 13 33	Control Valves		Mixing valves: 2" and under shall be globe. Over 2" shall be butterfly. Coil Valves (Load Control Valves): Valve operators shall be designed to remain closed (zero leakage) with 120% of the design head of the building pump across the valve seat.		
		23 09 23	Direct Digital Controls			1. Dynamic Controls, Inc. 2. Seimens 3. Johnson Consult with Facilities Planning and Construction for manufacturers	
				Energy Meters			
		23 11 23	Facility Gas Piping		< 2" psi be schedule 40 threaded indoor and outdoor; >2" psi to be schedule 40 . Indoor to be welded, outdoor threaded. Paint all outdoor gas pipe. Vent all regulators to outdoors		
		231126	Facility LP Gas Piping		< 2" psi be schedule 40 threaded indoor and outdoor; >2" psi to be schedule 40 . Indoor to be welded, outdoor threaded. Paint all outdoor gas pipe.		
		23 21 00	Hydronic Piping and Pumps	General	For each system the pumping design intent is Primary / Secondary / Tertiary (chiller / loop / building). Flow rate through the chiller (Primary) is constant, while flows in the distribution loop (Secondary) and building distribution (Tertiary) are variable. New equipment should be sized for 15 degree Delta-T. Clean all systems and perform 24 hour pressure test holding operating pressure.	1. Enfield 2. Fuseal 3.	
				Hot Water Supply/Return	<2" - Type L soldered copper, >2" - threaded, welded or gooved schedule 40.		
				Chilled Water Supply/Return	<2" - Type L soldered copper, >2" - threaded, welded or gooved schedule 40.		
		23 21 13	Hydronic Loops	General	Hydronic loops with pumps larger than two horsepower shall be equipped with variable speed pumps and controlled with DDC. Reheat systems shall be hydronic. Preheat systems shall be hydronic, glycol filled. Potassium Formate is a preferred substitute for glycol.		
				Distribution	Each building distribution loop shall have in line strainers installed on return line just before the pumps. In line rotary filters are preferred. Downstream of pumps, install line size globe style silent lift check valve. Provide positive isolation valves at first valve off the distribution loop. For sizes 6" or less use ball valves. For line sizes greater than 6", use double-offset butterfly valve with Teflon seat (class VI), stainless steel stem, bronze disc.		
		23 21 16	Hydronic Specialties	Pressure Reducing Valve System	The consultant is instructed to use self-powered PRV systems	BRAND ONLY 1. Spirax/Sarco	
				Balancing Valves, Water Strainers		1. Armstrong 2. B&G 3. Anderson	
				Triple Duty valves		1. Armstrong 2. Mueller 3. Watts	
				Expansion tanks		Must mate with pump manufacturer	
				Air Separators		1. Amtrol 2. Wessels 3. B&G	
						1. Amtrol 2. Tac 3. B&G	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		23 21 23	Hydronic Pumps		The building chiller water pump head shall be selected without future safety factor and as low as practical. Providing extra capacity (flow) is acceptable. The building pump head is only necessary for piping, accessories, coils, and process heat exchangers within the building loop. The design shall be a primary loop from the central chillers and each building served shall be via secondary loops. The loop may be somewhat oversized with a variable speed drive for each pump. All pumps shall have mechanical seals with carbon and ceramic seats. Provide stainless flanged flex connector on discharge and inlet, suction diffuser and triple duty valve on base mounted pumps	1. B&G 2. Taco 3. Aurora	
		23 22 13	Steam and Condensate Heating Piping	General	Non-electric, pressure powered pumps are preferred. Electric condensate pumps, when used, shall be duplex type. Control panel shall include "Hand-Off-Automatic" (HOA) selector switch and high level alarm contacts. A pre-assembled system is preferred. Provide high water alarm on all new condensate systems. Alarm shall be connected to the building automation system. New installations of electric condensate pumps shall be connected to an emergency power circuit, for uninterrupted service unless local disconnect is manually opened and locked out for maintenance. Clean all systems and perform 24 hour pressure test holding operating pressure.		
				HPS	<2" can be schedule 80 threaded, >2" can be schedule 80 welded		
				MPS, LPS	<2" can be schedule 40 threaded, >2" can be schedule 40 welded		
				MPC, LPC	<2" can be schedule 80 threaded, >2" can be schedule 80 welded		
				Pumped Condensate	<2" can be schedule 80 threaded, >2" can be schedule 80 welded		
		23 22 16	Steam and Condensate Heating Piping Specialties	Steam Traps - General	Allow sufficient room for the entire trap assembly. No short nipples shall be allowed. Total trap assembly from dirt leg to end of check valve shall not be less than five feet, nor more than seven.	1. Spirax/Sarco 2. Illinois Mechanical 3. Armstrong	
				Float and Thermostatic (F&T) Traps	Coils, heat exchangers, etc.	1. Sarco, FT1 2. Armstrong, B1 3. B&G	
				Thermostatic Traps	Unit heaters.	1. Sarco, FT1 2. MEPCO 3. Illinois	
				Bucket Traps	End of line steam mains.	1. Sarco, FT1 2. Armstrong, B1 3. B&G	
				Strainers	All traps and blow-offs shall have strainers. All wye strainers shall have valves and caps on the cleaning port.	1. Sarco, FT1 2. Armstrong, B1 3. Mueller	
				Pressure reducing valves	Self-powered	BRAND ONLY 1. Spriax/Sarco	
		23 22 23	Steam Condensate Pumps		Pressure powered pumps shall be of non-cavitating design powered by steam regulated to 60 psig and designed for condensate up to 350 degrees F. Operation shall be controlled by a float operated, snap-acting mechanism, with no external seals or packing. Flow direction shall be controlled by two stainless steel spring check valves. Provide mechanical alternator to start first one pump and then the other and arranged to automatically start the second pump if the rate of condensate return exceeds the capacity of the first pump. Pressure powered pumps shall be of the non-cavitating design and of the duplex design. Control panel shall include hand-off-auto switch and high level alarm contacts for BAS. Connect to a non-interrupted emergency power source.	1. Sarco (Model PPC) 2. Spirax 3. Armstrong 4. Weil	
		23 23 00	Refrigerant Piping		Hard soldered Type L copper preferred, soft copper line sets can be used where appropriate.		
		23 25 13	HVAC Water Treatment Closed System		All newly installed closed systems shall be chemically cleaned before being placed into service. Such cleaning shall be witnessed by the system designer, or his representative, and a representative of ISU. For all projects, engineer shall specify that chemicals supplied must match ISU's current, competitively-bid supplier. Further, the specifications shall require the contractor to confirm the chemical supplier with ISU before any chemicals are introduced into any system.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
					Provide for automatic control of both chemical feed and bleed-off, based on make-up water flow and conductivity levels. A safety pressure switch shall disable chemical feed when condenser water flow stops. Controls shall be compatible with and connected to the existing Apogee/Johnson BAS panel.		
					Corrosion coupon rack shall be provided with four 1" FPT openings for the mounting of corrosion coupons and shall include continuous flow regulation.		
				Chemical Pumps		1. LMI 2. Pulsatron 3. Neptune	
		23 25 16	HVAC Water Treatment Open System		For all projects, engineer shall specify that chemicals supplied must match ISU's current, competitively-bid supplier. Further, the specifications shall require the contractor to confirm the chemical supplier with ISU before any chemicals are introduced into any system.		
					Provide for automatic control of both chemical feed and bleed-off, based on make-up water flow and conductivity levels. A safety pressure switch shall disable chemical feed when condenser water flow stops. Controls shall be compatible with and connected to the existing Apogee/Johnson BAS panel.		
					Corrosion coupon rack shall be provided with four 1" FPT openings for the mounting of corrosion coupons and shall include continuous flow regulation.		
				Chemical Pumps		1. LMI 2. Pulsatron 3. Neptune	
		23 31 13	Metal Ducts	HVAC Ductwork, Fabricated Grease Duct	Ductmate or Formed on Flange Acceptable, Fabricate to SMACNA Standards based on static pressure, Seal all duct work to Class per SMACNA pressure rating, Leak test per SMACNA for any thing over 3".		
				Supply ductwork upstream of VAV boxes	4" sp rating, G-90 galvanized, Use only gasketed spiral for round		
				Supply ductwork downstream of VAV boxes	2" sp rating, G-90 galvanized		
				Exhaust ductwork	2" sp rating, G-90 galvanized		
				Return ductwork	2" sp rating, G-90 galvanized		
				Grease duct	Grease duct must be minimum 18 ga fully welded water tight, with clean outs installed per code		
				Dishwasher duct	2" sp rating, aluminum or stainless steel. Seal watertight		
		23 31 16	Non-Metal Ducts	Buried Ductwork	FRP, slope towards drain	1. Spunstrand 2. 3.	
				Lab Fume Ductwork	PVC solvent weld	1. Harris Plastics 2. 3.	
		23 33 30	Air Duct Accessories	Fire dampers	Prefered minimum 12" factory sleeve, Type B curtain, 165 degree fusible link	1. Ruskin 2. Greenheck 3.	
				Fire/Smoke Dampers	Prefered minimum 12" factory sleeve	1. Ruskin 2. Greenheck 3.	
				Access Doors	Install at points for visual inspection and allowance for cleaning. Hinged prefered, 16"x16" minimum size, see 08 31 16.		
				Volume dampers	Single blade damper for ducts < 12" wide, multiblade for > 12" wide. Provide stand-off bracket for externally insulated ductwork. F&I install ay all branch ductwork (less MP and HP)		
				Duct Silencers		1. Price 2. Ruskin 3. Vibro-acoustics	
		23 33 46	Flexible Duct	Flexible Duct		1. Wiremold 2. 3.	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		23 34 13	Fans, Axial		Provide accessories and factory coating appropriate for application	1. Greenheck 2. Cook 3.	
		23 34 16	Fans, Centrifugal		Provide accessories and factory coating appropriate for application	1. Greenheck 2. Cook 3. Trane	
				Grease/Kitchen Fans	Provide tilt-up fan wheel, discharge extension with rain diverter, disconnect switch	1. Captive Aire 2. Superior 3.	
				Lab exhaust fans	Self contained ventilation system with high plume discharge	1. Greenheck 2. Cook 3. M.K. Plastics	
		23 34 23	HVAC Power Ventilators		Provide hinged curb cap for cleaning and disconnect switch	1. Captiveaire 2. Greenheck 3. Cook	
		23 34 33	Air Curtains/Doors		Provide control package compatible with BAS	1. Berner 2. Mars 3. Powered Aire	
		23 35 33	Listed Kitchen Grease Duct		Prefabricated grease duct for kitchen exhaust. Must meet clearances per code	1. Van Packer 2. Metal Fab 3.	
		23 36 00	Air Terminal Units		1/2" minimum fiber-free liner. Controller and actuator field mounted by TC	1. Price 2. Titus 3.	
		23 37 13	Air Diffusers, Grilles and Registers		Air Devices to have NC <25	1. Price 2. Titus 3.	
		23 37 16	Fabric Air-Distribution Devices		Material selection, dispersion pattern and hangers shall be designed accordingly	1. DuctSox 2. FabricAir 3. Powered Aire	
		23 37 23	HVAC Gravity Ventilators		Provide hinged curb cap for cleaning	1. Ruskin 2. Greenheck 3. Cook	
		23 38 13	Commercial Kitchen Hoods		Design in the prescriptive method. Provide switches on hood face; provide energy efficient lighting, provide ANSUL system with appropriate cabinet. Provide smoke testing upon completion	1. Captiveaire 2. Greenheck 3. Larkin	
		23 38 16	Fume Hoods	General	Supply and exhaust air systems in laboratories shall be variable volume with flow serving the greater need of fume hood make-up, cooling load, or space ventilation. Variable exhaust should be achieved by variable fan speed and will be controlled to maintain a minimum fume hood face velocity of 80 FPM and an average face velocity of 100 FPM. A variable volume supply air box will modulate to regulate supply air flow. The supply box will be equipped with a reheat coil in rooms with hoods.		
				Fume Exhaust Fans	All fans used for fume exhaust shall be AMCA Type B spark resistant construction. Fans shall be Class 1 belted utility sets with a steel scroll sized to operate below 2,000 RPM. All components exposed to the air stream shall be coated with primer, baked enamel and baked Hersite. In-line centrifugal fans of the same material and coatings are acceptable where space precludes the use of a utility fan. Fans constructed of PVC or FRP shall be used where high concentrations of corrosives are anticipated. All fan sets will be driven by a minimum of two belts.	1. Harrington 2. 3.	
		23 41 00	Filters		Filters shall have a minimum efficiency of 80% and be of the bag type. In 100% outside air makeup conditions install pre-filters; roll advance type is preferred. Provide magnehelic gauge across all filter banks. Merv 8 pre-filter, Merv-13 Final filter. Max pressure drop 1.0" when dirty	1. AAF 2. Farr 3. Flanders	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		23 51 13	Draft Control Fans			1. Tjerlund 2. 3.	
		23 51 23	Gas Vents		B-Vent, Pressure Stack, AL29-4C	1. Van-Packer 2. Meta IFab 3.	
		23 52 00	Pressure Relief Devices		Safety Valves: ASME safety valves are the strongly preferred approach to protection of the low pressure system. Relief shall be set at 20 psig above the steam delivery pressure. The University recognizes the architectural considerations of such a system. Building floor plans and mechanical room layouts shall be adjusted to allow the use of a safety valve and vent stack to the roof. Safety valves will, however, eliminate the tripping of the steam system during periods of rapid load or inlet pressure swings. They also provide a visible means of detecting a malfunctioning PRV system. Steam outages caused by trip valves cannot be tolerated.		
		23 53 13	Boiler Feedwater Pumps		consult Facilities Planning and Construction for specific information for application		
		23 54 13	Electric Resistance Furnaces		Must meet energy code	1. Trane 2. Lennox 3. York	
		23 54 16	Gas Fired Furnaces		Must meet energy code	1. Trane 2. Lennox 3. York	
		23 55 13	Gas Fired Duct Heaters		Must meet energy code	1. Trane 2. Lennox 3. York	
		23 55 23	Gas-Fired Radiant Heaters		Provide combustion air intake and exhaust accordingly	1. Re-verber-ray 2. Schwank 3. Space-Ray	
		23 57 00	Heat Exchangers	General	All heat exchangers shall have a pressure rating of at least 200 psig at Watterson Towers, 175 psig at East Campus, and 150 psig at all other locations for both the shell and tube bundle, regardless of the operating pressures. For high pressure applications (above 15 psig), the shell and head shall be rated for the maximum steam temperature available at the building locations.	1. Bell and Gossett 2. BAC 3. Tranter	
				Shell and Tube	Low pressure exchangers shall be rated for 125 psig, with a 375 degree F head and shell rating, and a 300 degree F tube sheet rating.		
				Plate to Plate	2 pass minimum, factory insulated Stainless steel plates		
		23 62 00	Packaged Compressor and Condensing Units		consult FP&C for specific information for application	1. Trane 2. York 3. McQuay	
		236400	Packaged Water Chillers		consult FP&C for specific information for application	1. Trane 2. 3.	
		23 65 13	Cooling Towers	General	This guideline refers to open units greater than 200 tons. Galvanized construction, bare or painted, shall not be used. Diffuser pans/basins shall be stainless steel and shall have stainless steel covers. Collector basins and sumps shall also be stainless steel. Fiberglass pans are unacceptable. Media support and frame shall be stainless steel or approved non-ferrous material.	1. Marley 2. Baltimore Air Coil 3. Evapco	
				Access	Towers shall be furnished with ladders, handrails, guards and shrouds compliant with current OSHA regulations.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		23 70 00	Central HVAC Equipment	General	Furnish packaged air handling units complete with fans, motors, drives, coils, drain pans, filter sections, access sections, damper sections, and DDC control package. Units are to be factory tested and certified. Motor and drive combination shall be selected based on energy efficiency and compatibility.	1. Trane 2. Carrier 3. McQuay 4. Air Enterprises 5. Dunn and Bush	
		23 72 00	Air-to-Air Energy Recovery Equipment		Plate to Plate or heat wheel. Heat wheel for fume hood exhaust is prohibited. Provide preheat to prevent frosting where applicable	1. Semco 2. Greenheck 3. Renewaire	
		23 73 13	Modular Indoor Central Station Air Handling Units		Provide double wall insulated panels, stainless drain pans, provide pre-filters (MERV 8) and filters (MERV 13). See coil specification above	1. Trane 2. York 3. McQuay	
		23 73 33	Indoor, Indirect, Gas Fired Heating and Ventilating Units			1. Trane 2. 3.	
		23 74 13	Packaged , Outdoor, Central Station Air Handling Units			1. Trane 2. York 3. McQuay	
		23 74 23	Packaged Outdoor Heating only Make-up air Units			1. Greenheck 2. Trane 3. Reznor	
		23 74 33	Dedicated Outdoor Air Units for Heating and Cooling			1. Trane 2. 3.	
		23 81 13	Packaged Terminal AC Units-Through Wall Units		Provide wall sleeve, electrical terminal and exterior wall louver	1. Carrier 2. Amana 3. Friedrich	
		23 81 23	Computer Room AC units		Provide condensate pumps with alarm if required. Humidifiers within the units shall be electrode type, NOT Infrared. Liquid sensors shall be installed below the floor. Provide steam humidifier if applicable. Must be addressable by BAS	1. Liebert 2. Data Aire 3.	
		23 81 26	Split-System Air Conditioners		Provide low ambient operating down to 0 deg F. Line sets are acceptable	1. LG 2. Panasonic 3. Mitsubishi	
		23 82 13	Convection Heating and Cooling Units		Maximum coil face velocities shall be 475 fpm for chilled water coils, and 700 fpm for steam or hot water coils. Air handler coils shall be sized to maximize temperature rise and capacity; coils shall minimize water side and air side pressure losses. A 15 degree F. rise is standard for chilled water coils. Coils shall be eight (8) row coils. Cast iron headers are not acceptable; construct headers with seamless copper or bronze. Run-outs shall be the same material as the header with sweat connections on 2" and above.	1. Trane 2. Carrier 3. McQuay 4. Bohn	
		23 82 16	Coils		All coils shall have copper tubes and return bends with a minimum thickness of .035". Fin spacing of 10 FPI is preferred.	1. Trane 2. York 3. McQuay	
				Hot Water Coils	700 fpm maximum velocity		
				Chilled Water Coils	8 row minimum, drainable/vented headers. Stainless steel casing. Provide individual auxillary stainless steel drain pans. 500 fpm maximum velocity		
				Steam Coils	Provide drainable headers		
				Refrigerant Coils	Circuit according to application		
				Electric Resistance Coils	Provide step controllers and disconnect switch		
				Reheat Coils	Reheat coils shall be mounted separately from air terminal units with a 12-18" section of discharge duct between the air terminal unit and the reheat coil. Provide duct access panels adequately sized for inspection and cleaning of the coil in ductwork upstream and downstream of the coil. Min. reheat coil size is 8" x 8"		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		23 82 19	Fan Coil Units			1. Trane 2. Carrier 3. Dunham Bush	
		23 82 29	Radiators			1. Trane 2. Carrier 3. Dunham Bush	
		23 82 33	Convectors			1. Trane 2. Carrier 3. Dunham Bush	
		23 82 36	Fin Tube Radiant Heat			1. Trane 2. Carrier 3. Dunham Bush	
		23 82 39	Unit Heaters			1. Trane 2. Carrier 3. Dunham Bush	
		23 84 13	Humidity Control Equipment		Humidifiers shall be direct dry steam injection provided with a steam source independent of the Power Plant steam source, i.e., a steam-to-steam system. Evaporative humidifiers are not acceptable. Use of campus steam for direct humidification is expressly prohibited. Electric steam humidifiers will only be considered for buildings without access to campus steam.	1. Armstrong 2. Dri-Steam 3.	
Division 24 Reserved							
Division 25 INTEGRATED AUTOMATION							
		25 00 00	Integrated Automation	General	This standard covers systems and components supplied by the controls contractor and are to be used for all new construction and renovations.	1. Dynamic Controls 2. Johnson Controls 3. Siemens	
				Sub Metering	New construction shall include sub-metering for electrical, steam, chilled water, and condensate usage. All sub-metering shall be tied to the Apogee system for remote reading at the Power Plant.	Electrical sub-metering shall be done with Siemens Digital Energy Monitors (DEM) only.	
				Point Naming	Point names start with the CMS designation for each ISU building (CMS is the work order generation system used by Facilities). Point names include the name of the piece of equipment (fan, chiller, cooling tower, boiler, pump, etc.) followed by the number assigned to it.		
		25 13 16	Panels		Automation panels (MEC, MBC, NAE, or Nie's) in new installations shall be connected to an emergency power circuit in every building so equipped. Panels must be installed with 25% spare capacity for system growth.	Only acceptable panels are Siemens' mechanical equipment controllers (MEC), and modular building controllers (MBC); or, Johnson's network control units (NAE), and network control modules (NIE).	
		25 35 00	Sensors and Transmitters	General	Sensors appropriate to the type of physical quantity being monitored shall be provided. When transmitters are used, the cable length shall not exceed 600 feet.	1. Maca 2. Johnson Controls 3. Siemens 4. Serta	
				Sensors and Transmitters	Sensors appropriate to the type of physical quantity being monitored shall be provided. When transmitters are used, the cable length must not exceed 600 ft. Splices are not permitted within conduit. The transmitter shall produce a 4-20 mA signal which complies with the Instrument Society of America Standard S50.1. All transmitters shall be 2-wire devices, i.e., they should be powered by, and present their signals on, a single pair of wires. The Contractor shall provide a regulated, protected 24VDC power supply with the ability to produce at least 33% more current than required by the transmitters being installed. The Contractor will install the power supply in a NEMA 12 enclosure adjacent to the DDC panel.	The supplies shall have the electrical characteristics of Electrostatics, Inc. Models 10-24, 20-24, 30-24, 55-24, or 100-24, as appropriate to the current requirements of the installation.	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		25 35 19	Control Valves	General	Split ranging for heating and cooling valves controlled by DDC is not acceptable. DDC heating and cooling valves shall be software interlocked so both valves cannot be opened simultaneously.		
				Steam Valves	Steam control valves shall be rated for the highest system pressure and temperature and shall not lift when subjected to that pressure with the control system set to "fully closed" (10psig). All steam control valves shall have a body rating of 350 degrees F or higher, as appropriate. Trim shall be rated for 350 degrees F. Steam control valves shall have a published leakage rating of ANSI IV (.01% Cv). All steam control valves shall have an equal percentage plug unless a reason exists for a different taper.	1. Belimo 2. Johnson Controls 3. Siemens	
				Chilled Water Mixing Valves	2" and under – Characterized ball valves with a Cv selected to give a 2 to 4 psig drop. At maximum building flow valve shall seat against 20 psi differential pressure. b. Over 2" – Globe style (flanged), equal percentage flow characteristic Cv selected to give a 2 to 4 psig drop At maximum building flow valve shall seat against 20 psi differential pressure.		
				Chilled Water Coil Valves	Chilled water control valves shall be rated to remain closed (zero leakage) against the full shut-off head of the pumps, when the control signal is set to "fully closed". This may require a positioner. Valves shall all be two-way for variable speed pumping applications. Three-way valves may be required, under special circumstances.		
				Variable Frequency Drives	Alarms and control signals must communicate on a two-wire Floor Level Network (FLN), or a LAN, with the existing Apogee/Johnson system to allow remote sensing and control from a central location. For air handlers with constant volume fans, a soft start unit may be provided in place of a VFD.		
		25 30 00	Integrated Automation Instrumentation and Terminal Devices	General	Actuators shall be electric versus pneumatic in all new installations	1. Siemens 2. Belimo 3. Johnson Controls 4. Trane	
		25 91 00	Integrated Automation Control Sequences	General	Provide complete operating data, system drawings, wiring and schematic diagrams, written detailed operational description of sequences, and engineering data on each control system component.	Siemens. Any other vendor must demonstrate 100% compatibility with the existing Apogee system, provide upward compatibility of all system components.	
Division 26 ELECTRICAL							
		26 00 00	Electrical	General	System designer/specifier shall pay particular attention to life cycle cost, energy efficiency, accessibility, and ease of maintenance, when designing and specifying electrical work.		
					All exterior door locations shall include conduit for future installation of electronic security system. Conduit should extend from exterior doors to the facility's central telecommunications location. Use tracer wire above all direct buried non-metallic piping.		
		26 05 33	Raceways and Boxes	General	Threadless connectors and couplings shall not be used. Aluminum conduit of any kind shall not be used. Aluminum surface raceways shall not be used. Armored Cable (AC) – "Core Clad" shall not be used.		
		26 05 43	Duct Banks	Duct Banks	Concrete, min. 5" pvc ducts w/ at least one spare, include pull strings. Min. 48" radius at bends.		
				Manholes	The minimum size is: 8' Long x 6' Wide x 7'. High Reinforcing bars shall be located on the opposite wall and one foot below the horizontal projection of the lowest duct for each ductbank entering the manhole. Pulling irons shall be located on the opposite wall and one foot below the horizontal projection of the lowest ductbank entering the manhole. The manhole shall have a concrete floor sloping toward an effective gravity drain located 18" up the side of a 30" deep sump. The sump must be 18" on a side and have a cast iron grate with 1/2" holes. There shall be no downhill ductbank building entrances without a manhole before the building to prevent flooding in the building.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		26 10 00	Medium-Voltage Distribution	General	<p>Conductors shall be annealed copper, 98% conductivity.</p> <p>Minimum size conductor for general wiring shall be #12, stranded.</p> <p>All building conductors #2 and larger shall be THW or THHN.</p> <p>Conductors smaller than #2 shall be THHN.</p> <p>XHHW shall be used in wet locations for all sizes.</p> <p>Conductors for building feeder and branch circuits shall be insulated for 600 volts.</p> <p>Conductors for signal circuits operating at less than 50 volts shall be insulated for 300 volts.</p>		
		26 20 00	Low-Voltage Electrical Power Conductors and Cables	Splices	<p>Wires #8 and smaller: Pre-insulated solderless connectors</p> <p>Wires #6 through #4/0: Compression or split bolt type connectors</p> <p>Wires larger than #4/0: Compression or split bolt type connectors with minimum 2 pressure points per conductor.</p>	<ol style="list-style-type: none"> Dossert T&B Burndy 	
		26 20 00	Service and Distribution	General	Buildings with gross areas exceeding 40,000 square feet, or design loads exceeding 500 KW, shall be considered for dual secondary voltages (480/277, 208/120). The Consultant shall justify the selection and implementation of a dual system.		
		26 23 00	Main Secondary Switchgear		Switchgear shall be dead front, fully enclosed with front and rear accessibility provided.	<ol style="list-style-type: none"> General Electric Square D 	
		26 24 00	Panels	<p>High Voltage Panels (480/277):</p> <p>Low Voltage Panels (208/120):</p> <p>Motor Circuits</p> <p>Panel Boards</p>	<p>Any panel serving central or mainframe type computer loads, or UPS system(s) totaling over 50 KVA rating shall be fed with the neutral sized a minimum of 200% of the phase conductor ampacity.</p> <p>Any panel serving central or mainframe type computer loads, or UPS system(s) totaling over 50 KVA rating shall be fed with the neutral sized a minimum of 150% of the phase conductor ampacity.</p> <p>All motors shall contain thermal trip units through controls for motor protection.</p> <p>Provide for approximately 40% spare spaces in every panelboard. All panelboards shall be three-phase, 4-wire.</p>	<ol style="list-style-type: none"> General Electric Square D Cutler-Hammer 	
		26 27 13	Metering		Metering shall be on the secondary side of the building transformer bank. Metering shall consist of a voltmeter with phase selector switch, ammeter with phase selector switch, and KWH-demand meter. All meters shall be switchboard type, socket mount. Sockets shall have integral shorting bars for current transformer circuits to simplify meter removal for calibration. Meters shall be capable of being read remotely through connection to the existing Apogee building automation system.		
		26 27 26	Wiring Devices	General	All devices, light switches, and convenience receptacles shall be specification grade and shall be 20 amp minimum		
				Occupancy Sensors	All offices, laboratories, conference rooms, copier rooms, classrooms, and restrooms, shall have occupancy sensors installed to reduce energy consumption during unoccupied times. Restrooms shall have sufficient sensors properly positioned for lights to remain on while restroom is occupied.	<ol style="list-style-type: none"> Sensor Switch Hubbell Infracon 	
		26 29 23	Variable Frequency Drives		Alarms and control signals must communicate on a two-wire Floor Level Network (FLN), or a LAN, with the existing Apogee/Johnson system to allow remote sensing and control from a central location. For air handlers with constant volume fans, a soft start unit may be provided in place of a VFD.	<ol style="list-style-type: none"> Toshiba ABB Danfoss Square D Siemens 	
		26 33 53	Un-Interrupted Power Supply	Battery Back Up	ISU Administrative Technologies/ION will install and provision all UPS units once it has been delivered to the location(s) and all electrical power has been installed and tested.	<ol style="list-style-type: none"> APC SMT2200RM2U APC SYH4K6RMT-P1 	
		26 51 13	Interior Lighting	General	System designer/specifier shall pay particular attention to energy efficiency, accessibility, and ease of maintenance.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
					At least one lighting panel shall be provided per floor. All electric conduits shall originate on the same floor as room serviced.		
					Use of incandescent lights shall be kept to a minimum. Incandescent bulbs may be replaced with compact fluorescent bulbs, or low wattage halogen type.		
					Standard Fluorescents for existing systems are T8 lamps, 3500 degrees Kelvin. For new work, use energy efficient T8 lamps, 25 watt, with 25 watt ballasts and 4100 degrees Kelvin.		
		26 53 00	Exit Signs		Exit lighting shall be LED.		
		26 56 00	Exterior Lighting	General	High pressure sodium vapor lamps only are acceptable. Pole-mounted lights shall be identified with black and yellow numbers at 8 feet above finished grade facing walk or roadway. Pole identification numbers will be provided by Facilities Management. Quazite J-Box shall be placed adjacent to pole. Size shall be 12" x 12", or larger.		
		26 56 16	Vehicular Lighting Fixtures		Fixtures - DSX1 LED, 60C, 1000, 50K Pole - 5" sq tube, 0.188 wall thickness, rated for 100mph wind	1. Lithonia 2. Hubbell 3. Cooper	
		26 56 33	Pedestrian Light Fixtures		The traditional "Illinois State" fixture shall be used for areas of pedestrian traffic only. The fixtures are low (12-15'), and relatively close spacing (approximately 80') is required for safety, rhythm, and scale.	1. Sternberg 6610-FP4-DB-BK 2. Hadco Lighting P-2560- 10-BK 3. King Luminare KM22FE-10-BK.	
Division 27 TELECOMMUNICATIONS							
		27 05 53	Identification of Systems	Labeling	The University has adapted a unique labeling standard. Jack numbers for telephone/data combination outlets are derived from the position of the new telephone wire on the 66 blocks in the closet. Data only wiring requires an individual label for each jack and wire. The data wire numbers must be provided by the ISU Administrative Technologies/ION Structured Wiring division.	a. Bldg#-Room#-Floor#-Closet#-Jack# b. Building # = The Universities official building number, usually three digits. c. Room # - Room number where outlet is installed. d. Floor # - Is the floor that the terminal closet is located on. e. Closet # - Designates which closet on the floor that the outlet is served from. f. Jack # - The individual outlet number used to identify the wire on both ends	
		27 10 00	Structured Cabling	Telephone Risers	All copper telephone riser cables must be type 24 gauge in conduit, have industry standard color coding, have 25 pair groups in 100 pair bundles, and meet the specifications outlined by the NEC and the EIA/TIA. ISU Administrative Technologies/ION uses the following formula to determine sizing of riser cables in administrative or academic buildings. Number of telephone outlets times two plus 30 percent. Each telephone outlet has one dedicated path back to the nearest NODE site. Installations that have been designated as "Voice Over IP" (VOIP) installations will only require a 25 pair riser cable per closet. Sizing the cable as described above will not be required.	THESE PRODUCTS ARE EXAMPLES OF THE EQUIPMENT AND DEVICES TO INCORPORATE INTO THE STRUCTURED CABLING SYSTEM. DESIGNER SHALL SUBMIT PRODUCT LITERATURE FOR APPROVAL.	
				Data Risers	All data riser cables must be hybrid fiber optic cables. Each IDF closet will have a homerun 12/12 fiber optic riser cable to the BDF to serve the data electronics. The contractor will supply, place, terminate, and test the fiber optic riser cables. The contractor will supply and install 19" data racks (usually two) in the data closets.	1. Corning FDC-003 Combination distribution box for 24 fibers with splice trays. One per IDF. 2. Corning FDC-CM-12-58 12 strand single mode pigtail module. Two required per cable.	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
						3. Corning 024X81-331XX-24 12MM/12SM hybrid fiber optic cable. Length (no splices) from the BDF to IDF determined by contractor. Homeruns from each IDF to BDF are required.	
						4. (24) Corning MM ST light guides, part# FDC-CP1P-15	
						5. (4) Corning MM ST connectors, part# 95-100-01R	
		27 11 13	Data Entrance Cable		The data entrance cable will consist of a continuous, unspliced, hybrid fiber bundle that is installed by the contractor from the building entrance termination point to a data switching center to be determined by ISU Administrative Technologies/ION. This fiber bundle shall be contained in a black outer sheath and shall be a loose tube fiber design with a non-conductive center core.	1. Corning ALTOS Gel Free fiber hybrid bundle 2. Exterior splice cases in manholes or tunnels must be stainless steel Preformed Line Products (PLP) brand. 3. Termination of the entrance cable at the BDF will be on 100 pair Emerson/Reliable brand RELTEC R366AA100D protectors.	
		27 11 16	Data Closets	Closet Requirements	Traditional telephone service is powered remotely from the telephone switching center. VOIP telephone service is powered locally from the IDF/BDF closets. It is recommended that an EM generator be designed into new construction and major renovations plans so that telephone and data services are not lost during a power outage. In situations when a generator cannot be installed, sufficient power must be provided in the IDF/BDF closets to support UPS devices.		
				Closet Terminations	At the IDF/BDF or data cabinet all conductors of each station wire will be terminated. Telephone station wiring will be terminated on standard 66M1-50 split 50 mini 66 blocks. 89B-mounting brackets for each block are also required.	Product approval required.	
				Closet Wiring		Product approval required.	
		27 13 00	Optical Fiber Backbone	General	See notes on building entrance above. Buffer tube color and fiber color to be provided by ISU Administrative Technologies/ION. THE CAMPUS IS CURRENTLY UTILIZING, BUT NOT LIMITED TOO, THE PRODUCTS NOTED.	Multimode - Corning (FDC-CP1P-15) FDC panel-preloaded with 6 ST multimode adapters (CAI). Corning (95-100-01R) ST connectors UV, glass in ceramic, 125um, multimode 3.0mm jkt.	
						Single mode – Building Entrance/Main Tel-Data Room. Corning (FDM12P12-3C-RH000) 12 port, single mode, LC Ultra PC connector module with 900um, single mode, 3-meter MIC pigtaills contained in one sheath. Terminating 48SM will require eight (8) modules.	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
						Single mode – Riser Tel-Data Room(s): Corning (FDM12P12-3C-RH000) 12 port, single mode, SC Ultra PC connector module with 900um, single mode, 3-meter MIC pigtails contained in one sheath. Terminating 12SM will require two (2) modules Corning (2806031-01) fusion splice protection sleeve heat shrinks for splice tray. Corning (M67-048) 12 fiber splice tray TR/HSF. Will require one tray for each 12 strand tube of single mode optical fiber.	
						FDC-72 Box - Corning (FDC-CMH-072) 72-F capacity FDC fiber distribution center. All fiber at the main tel/data entrance room will terminate in FDC-72 housings.	
						FDC-003 Box - Corning (FDC-003) 24-F capacity FDC fiber combination box with splice trays. All fiber in the tel/data riser rooms will terminate in a FDC-003 housing.	
						Splice Box - Corning (FDC-SMH-5) 24-tray capacity FDC fiber splice module housing. Required in the main entrance tel/data room only.	
		27 15 01	Horizontal Station Wiring	Voice/Data Wiring, Network/VoIP Telephone/Wireless, and Battery Backup Equipment	The data station cable shall be: blue, plenum rated, UL listed as Type CMP meeting NEC Section 800: and meet category 6 cable performance requirements as listed in UL's Cable Certification Program. Belden Data Twist 600e (7852A Blue) is the University standard and is required. All terminations must comply with manufacturer's specifications.	Systemax 24 AWG 4 Pair station wire-Systemax product code 2010 004BWH 4/24 R1000, comcode 107 078 396, is the University standard and is required.	
				UPS Battery Back Up	See 26 33 63 ISU Administrative Technologies/ION will install and provision all UPS units once it has been delivered to the location(s) and all electrical power has been installed and tested.		
		27 15 43	Station Jacks		Station jacks and faceplates are to be provided by the contractor and installed in metal single or double gang outlet boxes. All outlet components are Ivory colored, manufactured by Krone, is the University standard, and is required.	Data station jacks are to be Krone modular inserts (6830-1-830-02), Ivory, 8 conductor, RJ45 jacks using the T568B standard.	
						Krone flush-mount Ivory faceplates are required. The most commonly used faceplate is the single gang Krone 4-Port (6644-1-154-02) faceplate that will accept four snap-in termination modules. The four-port faceplate is used for most administrative installations where University standard telephone only, telephone/single data, or telephone/dual data wiring standards are specified. In student resident rooms the Krone eight port (6644-1-178-02) two gang angled faceplate is required	
						Unused space in the faceplate will require a Krone Ivory blank insert (6645-1-160-02).	

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
						In student resident rooms the CATV service also terminates in the Krone eight-port faceplate with the telephone and data jacks. The Krone F-81 connector insert (6645-1-157-02) that is used for CATV application is usually installed by others unless specified in the project documents.	
		27 21 00	Network Equipment		ISU Administrative Technologies/ION staff will install and provision all network equipment once it has been delivered and all wiring closet field termination work has been completed and tested.	1. Cisco Chassis	
		27 21 33	Wireless Equipment	Equipment	ISU Administrative Technologies/ION staff will install and provision all wireless equipment once it has been delivered and all wiring closet field termination work has been completed and tested.	Aruba Networks wireless equipment, which includes the following components: 1. AP 320	
				Enclosures	Locations that have raised ceilings	CPI Chatsworth and the following part numbers, TS1009686 (custom number) and AAT-WME-P. ATT-WME-P	
					Locations were it is necessary to mount enclosures to walls	CPI Chatsworth and the following part numbers, TS1009686 (custom number)	
		27 31 23	VoIP Telephone Equipment		ISU Administrative Technologies/ION staff will install and provision all VoIP telephone equipment once it has been delivered and all wiring closet field termination work has been completed and tested.	Cisco Systems based on the components provided below: 1. CP-7937G 2. CP-7937-MIC-KIT 3. CP-7945G 4. CP-7911 5. CP-7975G 6. CP-6921	
		27 35 20	Emergency Telephone	Telephone Kiosk	Telephone kiosk with bronze finish. 84"H x 16 1/2" dia. Lighted "EMERGENCY" panel to be included. Panel to be blue with white letters. Will be acquired by Owner, installed by contractor.	1. Kiosk - Industries Jaro, Inc., Model J070 2. Emergency Telephone - GAI-Tronics Model 293 AL-001 3. Strobe - GAI-Tronics Model 530FB	
Division 28 ELECTRONIC SAFETY AND SECURITY							
		28 31 00	Fire Alarm System		24 Volt DC closed circuit. All systems shall be non-coded type. Wired as a Class "A" system throughout, including initiating and audible alarm circuit, except as noted. Manufacturer shall state maximum external load and circuit resistance for each system for battery back-up operation. Provide with project submittals. The integrated fire alarm system shall be UL listed.	DUAL SOURCE ONLY 1. Siemens 2. Simplex	
		28 31 11	Fire Alarm Network		The Fire Alarm Network is a fiber network that all fire alarm systems report to. It is a Simplex product. The majority of fire alarm panels on campus are Simplex. There are two "servers" one is located in the electric shop 102 PPS the other is located in the EHS office in NSB. ISUPD has a display for notification to the police department. The Heating Plant has the software on the machine in the water test room. The University is currently running the Simplex network and the Apogee fire alarm reporting in parallel, the goal is to use the Simplex Network as the only means of fire alarm reporting for the campus.	1. Simplex	
		28 31 23	Fire Alarm Control Panel		Dead front construction with lockable door and a minimum of 2 keys. Modular design. Provisions for 20% expansions.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		28 31 46	Automatic Smoke Detectors		Provide combination smoke/heat detectors. Photoelectric, solid state type with 360-degree smoke entry and sensitive to both black and gray smoke.		
		28 31 63	Audible Signal Appliance		All audible devices shall be speakers		
Division 29 <i>Reserved</i>							
Division 30 <i>Reserved</i>							
Division 31 EARTHWORK							
			Not Used				
Division 32 EXTERIOR IMPROVEMENTS							
		32 12 16	Asphalt Paving		Bituminous surface shall be laid on an 8" aggregate compacted base. New surfaces and overlays on existing parking surfaces shall consist of a 1½" base course and a 1½" finish course for a total minimum of 3" of asphaltic concrete. Overlays will be done only after appropriate patching and subsurface repair has occurred. Surface parking areas shall be designed to allow for the drainage of rainwater.		
		32 11 00	Aggregate Base Course		Conform to IDOT Spec. Sect. 1000, ref. 1004.1 for allowed CA-4 or CA-6 gradation, 100% crushed quarry rock.		
		32 11 13	Bituminous Surface Course		Conform to IDOT Spec. Sect 405 and 406, ref. 406.04 for Type 1, Mixture C.		
		32 11 26	Bituminous Binder Course		Conform to IDOT Spec. Sect. 405 and 406, ref. 406.04 for Type 1 or 2, Mixture B.		
		32 16 13	Curbs and Gutters		All concrete curbs, sidewalks and drives shall meet the standards of the current Illinois Department of Transportation Standard Specification for Road and Bridge Construction .		
		32 16 23	Concrete Sidewalks	General	Sidewalks shall be built of 4,000 psi fiber mesh reinforced concrete to dimensions and at locations shown on the drawings. Maximum size of course aggregate shall be 1 1/2 inch. Concrete shall have a slump of between 1 1/2 and 4 inches. The concrete mixtures shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer of five to seven percent. Air content shall be determined in accordance with ASTM C 231. Compounds containing calcium chloride shall not be used. Sidewalks shall be six inches thick and reinforced with fiber mesh at all locations.		
				Sidewalk Pattern	University standard sidewalk dimensions at 5 feet by 5 feet modules (unless identified at pre-bid to be a different dimension). Sidewalks shall have a brushed surface with a 4 inch troweled edge as a finish.		
		32 33 13	Bicycle Racks		See Appendix		
		32 33 43	Landscape Forms	Site Seating		1. Presidio 2. Plexus 3. Carousel	
		32 91 19	Topsoil		Imported Topsoil shall be natural, fertile, agricultural soil typical of locality, capable of sustaining vigorous plant growth from well drained site free of flooding, not in frozen or muddy condition, not less than six percent organic matter and PH value between 5.4 and 7.0. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, crabgrass, coughgrass, noxious weeds and foreign matter. Use topsoil excavated from site only when it conforms to these specifications. Provide a Combination 3-1-2 fertilizer at 3# nitrogen/1000sf for areas to be sodded and a Combination 2-3-2 fertilizer at 5# nitrogen/1000 sf for areas to be seeded.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		32 92 16	Seed		Contractor shall apply grass seed blend of 100% 3 way blend of perennial ryegrass at a rate of 15 lbs per 1,000 square feet evenly in two intersecting directions by using a rotary or drop type spreader.		
		32 92 23	Sod		Sod shall be 100% blend of improved Kentucky bluegrass varieties.		
		32 93 00	Exterior Plants		See Appendix		
Division 33 UTILITIES							
		33 05 26	Utility Identification	Tracer Wire	Tracer wire shall be used above all direct buried ductile iron piping and all non-metallic piping.		
		33 08 00	Commissioning	Commissioning of Utilities	See appendix		
		33 12 33	Water Meter		Water meters are required on building entrance service. Meter shall conform to Town of Normal requirements. Consult Facilities Management for remote readout requirements.	Neptune T10 with E2 remote reading head (to be provided by Illinois State University)	
		33 71 00	High Voltage Distribution	General	System designer/specifier shall pay particular attention to life cycle cost, energy efficiency, accessibility, and ease of maintenance.		
				4.16 KV System and 13.8 KV System	Single copper conductor, class B, insulated, metallic/non-metallic shield, 80m black PVC jacket	1. Kerite 2. 3.	
				Primary Substation Switchgear - 4.16KV	Switchgear located at the substation for radial feeders shall be pad mounted switches and shall be listed for outdoor use. Minimum ratings shall be 60,000 amps rms symmetrical short circuit current and 270 Short Circuit MVA, three phase symmetrical at rated nominal voltage.	1. S & C 2.	3
					Switchgear access doors shall have an integral keyed lock in addition to a safety interlock. The safety interlock shall prevent opening access doors with the switch in the closed position, and closing the switch if the door is open. The interlock shall be proof against defeat.		
					Each switchgear cubicle shall be provided with watt hour-demand metering. The primary switchgear shall include phased potential transformers (including spare fuses), current transformers, voltmeters, and selector switch, ammeters, and selector switch, and kilowatt meter. Watt hour-demand meters shall be a switchboard type with socket mount. The socket mount shall have integral shorting bars for the current transformers to simplify meter removal for calibration. Watt hour meters shall have provision for pulse output, capable of communicating over a two-wire FLN link to ISU's Apogee system.		
				Unit Substation (Building) Switchgear & Transformers - 4.16 KV or 13.8 KV	Switchgear for unit substations feeders shall be pad mounted. Minimum ratings shall be 40,000 amps rms symmetrical short circuit current and 180 Short Circuit MVA, three phase symmetrical at rated nominal voltage.	1. S & C "Vista" 2.	3
					Switchgear access doors shall have an integral keyed lock in addition to a safety interlock. The safety interlock shall prevent opening access doors with the switch in the closed position, and closing the switch if the door is open. The interlock shall be proof against defeat.		
					Automatic transfer between 4.16 KV feeders on double ended systems will not be considered. Automatic transfer in the event of a building feeder loss shall take place on the low voltage side of the building transformers.		
		33 73 00	Unit Substation Transformers		Indoor transformer vaults must be accessible from both inside and outside of the building. The outside entrance must be large enough to allow installation and removal of the primary switchgear, transformer, and secondary switchgear without component disassembly. No PCB contaminated (50 ppm or greater) transformers will be allowed. Transformers shall have manual tap changes, interlocked with supplying switchgear to prevent energized tap changes. Taps shall be two at 2.5% above nominal voltage, and two at 2.5% below nominal voltage. Transformers shall retain their nominal KVA ratings at all tap settings. Outdoor transformers shall be oil filled type. No indoor transformers shall contain fluid. All transformers shall be protected with surge arrestors.		
		33 77 00	Pad Mounted Transformers		Concrete pads shall be designed with a pit under the primary cable compartment to provide a minimum of 36" of exposed cable under the primary bushing.		

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
		33 75 36	Primary Overcurrent Protection		A separate, fused primary interrupter switch shall be used with larger transformers. A complete set of spare fuses shall be supplied.	1. S & C "Vista" 2.	3
		33 77 00	Pad Mounted Transformers		Concrete pads shall be designed with a pit under the primary cable compartment to provide a minimum of 36" of exposed cable under the primary bushing.		
		33 79 19	Grounding		A continuous grounding system shall be provided for grounding of primary cable shields, switchgear and transformer frames and transformer secondary neutrals. The grounding system shall consist of a grid embedded in the vault floor. A bare 4/0 copper grounding conductor shall run around the perimeter of the vault, at six inches above the floor, and shall be connected to the ground grid at not less than eight foot intervals.		
		33 81 26	Manholes		Manholes shall either have round lids or fixed-hinged lids to prevent manhole cover from dropping into manhole.		
Division 34		TRANSPORTATION					
			Not Used				
Division 35		WATERWAY AND MARINE CONSTRUCTION					
			Not Used				
Division 36		Reserved					
Division 37		Reserved					
Division 38		Reserved					
Division 39		Reserved					
Division 40		PROCESS INTEGRATION					
			Not Used				
Division 41		MATERIAL PROCESS AND HANDLING EQUIPMENT					
			Not Used				
Division 42		PROCESS HEATING, COOLING AND DRYING EQUIPMENT					
			Not Used				
Division 43		PROCESS GAS AND LIQUID HANDLING EQUIPMENT					
			Not Used				
Division 44		POLLUTION CONTROL EQUIPMENT					
			Not Used				
Division 45		INDUSTRY SPECIFIC MANUFACTURING EQUIPMENT					

**Illinois State University
Design Construction Standards
Based on CSI 49 Division Format**

ISU	A/E	Section	Title	Heading	Description	Products	Revision Date
			Not Used				
Division 46		<i>Reserved</i>					
Division 47		<i>Reserved</i>					
Division 48		ELECTRICAL POWER GENERATION					
			Not Used				
Division 49		<i>Reserved</i>					