OCP HOME UIC OFFICE FOR CAPITAL PROGRAMS
The University of Illinois at Chicago

BUILDING STANDARDS

The building standards are under construction and being revised periodically. Click on the divisions below for current standards. Please check with your Project Manager for further information, if no detailed information exists below.

The UIC CAD Standards are a part of these Building Standards.

When printing separate Divisions, you may wish to set page margins to 0" on the left and right for best results. The complete Building Standards are available for download in PDF format, here: UIC Building Standards.

For the Master updated information of recent additions or deletions to current standards please go to the Master Revisions Index page.

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Building Standards last revised 2008.02.21

BUILDING STANDARDS

DIVISION 01 -- GENERAL REQUIREMENTS

014200 REFERENCES

The codes, regulations and standards represent the minimum quality and safety which should be provided.

These data should not be considered as a complete or comprehensive listing and should be elaborated upon by the Architect or Engineer to secure a completed project of the quality indicated. The A/E is responsible for investigating and determining which codes are applicable at the project site, and for designing and specifying accordingly. A/E may submit written requests to the University, with full documentation, requesting deviations from the codes, or the substitutions of more stringent codes. Do not proceed with design or specifications based on deviations or other codes until written authorization is received. This Article on Codes, Regulation and Standards shall apply to all Divisions of the Building Standards.
Construction work for the University of Illinois at Chicago campus shall comply with the City of Chicago Building Code and all other applicable standards, codes, laws or regulations. When other applicable standards, codes, laws or regulations conflict with the City of Chicago Building Code, these conflicts shall be brought to the attention of the UIC Office for Capital Programs with a recommendation of how to address the conflict. Applicable standards, codes, laws and regulations include, but are not limited to, the following list. The current edition of these documents shall apply.

	Abbreviations and Acronyms
ANLA	American Nursery & Landscape Association
ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
AGA	American Gas Association
AGCI	Associated General Contractors of Illinois
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASHRAE	American Society of Heating Refrigeration and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Waterworks Association
CDB	Capital Development Board
CPSC	Consumer Product Safety Commission (Federal)
FED	Federal Agencies
FM	Factory Mutual Engineering Corp.
IAC	Illinois Accessibility Code
IAGO	Illinois Attorney General's Office
IBOG	Illinois Board of Governors
IBOHE	Illinois Board of Higher Education
IDOL	Illinois Department of Labor
IDOT	Illinois Department of Transportation
IDPH	Illinois Department of Public Health
IDRE	Illinois Department of Registration & Education
IEEE	Institute of Electrical and Electronic Engineers
IEPA	Illinois Environmental Protection Agency
IHPA	Illinois Historical Preservation Act
ILCS	Illinois Society of Professional Engineers
ISPE	Illinois Society of Professional Engineers
JULIE	Joint Utility Location Information for Excavators
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NIH	National Institutes of Health
OSFM	Office of State Fire Marshal
OSHA	Occupational Safety & Health Act (1970)
SMACNA	Sheet Metal & Air Conditioning Contractors National Association
SOS	Secretary of State

UBC	Uniform Building Code
UFAS	Uniform Federal Accessibility Standards
UI	University of Illinois
UICBS	University of Illinois at Chicago Building Standards
UL	Underwriters Laboratories, Inc.

Regulatory Requirements

1. **ACGIH**: Industrial Ventilation
2. **ADA:** The Americans with Disabilities Act, Public Law 101-336, July 26, 1990.
3. **FED:**
   a. CPSC: Architectural Glazing Materials. (Partially preempts Illinois Safety Materials Glazing Act). Coordinate.
   b. DHEW:
      1) Title V: Handicapped Accessibility.
      2) Title IX: Regulations Prohibiting Sex Discrimination in Education.
   c. EPA: Title III Fact Sheet: Emergency Planning & Community Right-to-know.
   d. NIH: Guide for the Care & Use of Laboratory Animals, Publication DHHS #85-23.
4. **IAC:** The Illinois Accessibility Code, 71 Illinois Administrative Code, Chapter 1, Sec. 400.
5. **IAGO:**
   a. Illinois Environmental Barriers Act. (Coordinate with CDB "Illinois Accessibility Code").
   b. Illinois Steel Products Procurement Act, as amended (Illinois Revised Statutes, ch. 48, par. 1801 et seq.).
6. **IDOL:** Safety Glazing Materials Act, as amended, with interpretive statement (Illinois Revised Statutes, ch. 111 12. par. 3101 et seq.).
7. **IDOT:**
   Bridge Manual, including all supplements, current at date of bidding documents, unless otherwise specified.
   a. Design Manual, including all supplements, current at date of bidding documents, unless otherwise specified.
   b. Road and Bridge Laws, including all supplements.
   c. Standard Specifications for Road and Bridge Construction, including all supplements, except where otherwise specified.
      1. Change all references "Engineer" to "Architect/Engineer".
      2. References to "Method of Measurement" and "Basis of Payment" may not apply.
   d. Manual on Uniform Traffic Control Devices for Streets and Highways.
   e. Policy for Permits for Access Driveways to State Highways.
8. **IDPH:**
   a. Illinois State Plumbing Code.
   b. Cir. 19.000, Retail Food Store Sanitation.
   c. Cir. 1 9.001, Food Service Sanitation.
   d. Cir. 4.102, Minimum Sanitary Requirements for Design and Operation of Swimming Pools & Bathing Beaches.
   e. Requirements for the Design of Wisconsin Mounds in Illinois.
   f. Lead Poisoning Prevention Act (Dwelling Units Only).
   g. Rules and Regulations for Recreation Areas.
   h. Hospital Licensing Act and Requirements.
   i. Long-term Care Facilities, Minimum Standards, Rules and Regulations.
      1. Intermediate Care Facilities.
      2. Skilled Nursing Care Facilities.
      3. Sheltered Care Facilities.
      4. For Persons Under Twenty-Two Years of Age.
   j. Ambulatory Surgical Treatment Centers, Revised Rules, Regulations and Standards.
   k. Clinical Laboratories and Blood Banks, Rules and Regulations.
   l. Illinois Asbestos Abatement Act (Illinois Revised Statutes, ch. 122, par. 1401 et seq.).
   m. Rules and Regulations for the Asbestos Abatement Act - Title 77, ch. I, sub ch. p. Part 855.
9. **IDRE:** Illinois Roofing Industry Licensing Act, as amended (Illinois Revised Statues, ch. 111, par. 7501 et seq.).
10. **IEPA:** (Current editions at date of bidding documents.)
    a. Air Pollution Standards.
    b. Noise Pollution Standards.
    c. Water Pollution Standards.
    d. Public Water Supplies.
    e. Solid Waste Standards.
    f. Illinois Recommended Standards for Sewage Work.
11. **Illinois Purchasing Act**, as amended (Illinois Revised Statutes, ch. 127, par. 132.1 et seq.).
12. **OSFM:**
    a. Gasoline and Volatile Oils (Illinois Revised Statutes, ch. 17 1/2, par. 31 et

seq.).
   b. Liquefied Petroleum Gases (Illinois Revised Statutes, ch. 104, par. 119 et seq.).
   c. Liquefied Petroleum Gas Containers (Illinois Revised Statutes, ch. 104, par. 113 et seq.).
   d. Boiler and Pressure Vessel Safety Act and Rules and Regulations (Illinois Revised Statutes, ch. 127 1/2, par. 151 et seq.).
   e. Tactile identification on Certain Elevators (Illinois Revised Statutes, ch. 111 1/2, par. 3901 et seq.).
   f. Installation of Elevators (Illinois Revised Statutes, ch. 111 1/2 par. 4001 et seq.).
   g. Illinois Rules and Regulations for Fire Prevention and Safety.
   h. Illinois Fire Prevention and Safety Laws and Fire Protection District Laws.
13. **SOS:**
   a. Ramp on All New or Reconstructed Curbs for Persons Using Wheelchairs. (Illinois Revised Statutes, ch. 24, "Illinois Municipal Code", Sec. 11-80-11. Public Act 78-322, as amended.)
   b. Environmental Barriers Act, as amended (Illinois Revised Statutes, ch. 111 1/2, par 3701 et seq.). (Coordinate with CDB "Illinois Accessibility Code".)
   c. Lead Poisoning Prevention Act, as amended (Illinois Revised Statutes, ch. 111 1/2 par. 1301 et seq.). (For dwellings or dwelling units, as defined).
14. **UBC:** Laboratories for Semiconductor Research and Instruction - H6 Classification, Section 9.
15. **STANDARDS:** The following standards are complementary to specified statutorily mandated codes and standards.
   a. AAN: American Association of Nurserymen, Inc.
   b. ACI: Manual of Concrete Practice
   c. AGCI/ISPE: Standard Specifications for Water and Sewer Main Construction in Illinois.
   d. ANSI:
      1. ANSI No. A.17.1 with Supplements, American Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks.
      2. ANSI No. A.58.1, American National Standard Minimum Design Loads for Building & Other Structures.
   e. ASHRAE No. 62-1989, Ventilation for Acceptable Indoor Air Quality.
   f. ASHRAE No. 90.1-1989, Energy Conservation in New Building Design.
   g. AWWA: American Water Works Association, Water and Sewer Main Construction.
   h. NFPA: National Fire Protection Association, Current Fire Codes/Standards as may be appropriate to the project.
      1. National Electrical Safety Code, latest revision.
   i. Uniform Building Code, Chapter 9, group H Occupancy, Division 6 Semiconductor Fabrication Facilities.
   j. UIC Building Standards
16. **OSFM:**
   a. "Illinois Rules and Regulations for Fire Prevention and Safety", as amended through 9 III. Reg. 10009, and as recodified: Comply with NFPA 101 except:
   b. Mixed occupancies (administrative offices, maintenance areas, etc.): Comply with NFPA 101, 15-1.2, as appropriate for the respective occupancy. (Where NFPA 101 is incorporated by reference, do not incorporate later amendments.)
17. **IHPA:**
   Illinois State Agency, Historic Resources Preservation Act, III. Rev. Stat. 1989, Chap. 127, Para. 133C21 et seq., and Its Implementing Regulations, 17ILL. Admin. Code, Chap. VI, Part 4180, Rules for the Review of State Agency Undertakings.
18. **EHSO:**
   1) Environmental Health and Safety Office, University of Illinois at Chicago, Hazardous Waste Management Manual.

017700 CLOSEOUT PROCEDURES

017823 OPERATION AND MAINTENANCE DATA

Contractor shall submit all Operation and Maintenance Manuals prior to submitting the pay request that brings the project to 50% complete. The Operation and Maintenance manuals shall be submitted following the order listed below.

- Provide an index of all documents, letters and manuals submitted
- Submit a list of all equipment purchased and installed in the project providing detailed information for every trade as shown in the table below.

Specification Number	Trade	Supplier/ Subcontractor	Contact Information (Name, phone, e-mail)	Warranty Period (start and end dates)

- Submit a copy of all letters of warranty for every unit, device or system installed specifying dates of extension and/or time of duration. The letter of warranty shall be signed and dated by the corresponding subcontractor or supplier.
    - If specific devices belonging to the system have a different period of duration than the one specified in the unit a letter of warranty for such devices shall be submitted separately (e.g. compressors in condensing units).
- Submit all installation, operation and maintenance information for all equipment installed in the same order as called in the specification providing the corresponding name and number. When information from different divisions are to be submitted insert additional separation sheets with tabs detailing the division number and name.

BUILDING STANDARDS

DIVISION 02 -- EXISTING CONDITIONS

024116.13 BUILDING DEMOLITION

- Historic objects and other items of interest or value to the University that may be encountered during building demolition remain the University's property. Coordinate with the University the removal and salvage of each item or object in a manner to prevent damage and deliver promptly to the University. After building demolition is complete, submit a list of items that have been removed and salvaged.
- Provide not less than two (2) weeks' notice to the University of activities that will affect the University's operations. Maintain access to existing walkways, exits, and other adjacent occupied or used facilities. Do not close or obstruct walkways, exits, or other occupied or used facilities without written permission from authorities having jurisdiction. The University assumes no responsibility for buildings and structures to be demolished.
- If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and the University, except under procedures specified elsewhere in the Contract Documents. Hazardous materials will be removed by the University under a separate contract.
- If hazardous materials are present in buildings and structures to be demolished, a report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
- Under the direction of Facilities Management, locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished. If utility services are required to be removed, relocated, or abandoned, before proceeding with building demolition provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
- Protect construction to remain against damage and soiling during demolition.
- Demolish foundation walls and other below-grade construction that is within 5 feet outside of footprint indicated for new construction. Remove below-grade construction, including basements, foundation walls, and footings, completely. Abandon below-grade construction outside this area.
- Demolish abandoned utilities back to the source of junction.

024119 SELECTIVE STRUCTURE DEMOLITION

- All Utility shutdowns must be scheduled in advance so as not to interfere with University operations. The University must be notified at least two (2) weeks prior to removal of any work connected to utilities so that arrangements can be made for proper disconnection of such utilities. The locations of all known gas lines, underground telephone cables, underground electrical cables and conduit, water lines, chilled water lines, sanitary and storm sewer lines, and steam lines must be marked before performing any work.
- Existing valve boxes and manholes should be protected so they will not be crushed, buried with earth or covered with construction material and made inaccessible.
- Existing structures, foundations and masonry under new structures should be completely removed unless otherwise approved by the University.
- Existing structures, foundations and masonry not under new structures shall be removed to a depth of at least 5 feet below finished grade.

BUILDING STANDARDS

DIVISION 03 -- CONCRETE

030000 CONCRETE

- There are no unique University Standards for this section.

BUILDING STANDARDS

DIVISION 04 -- MASONRY

040000 MASONRY

- Provide mortar net in cavity walls with weeps at 24" o.c. Weep rope or honeycomb blocks are to be used.
- Back parge cavity walls.
- Provide full head joints.
- Steel plates at lintels shall be held ½" away from masonry jamb opening.
- Through wall flashing to be "IPCO" type stainless steel drip edge. All flashing to be dammed at ends and weeped.
- Chicago common brick should not be used.
- Provide horizontal control joints at a minimum of every other floor.
- Only pre-bagged factory batch mix mortar will be allowed. No field mix allowed.
- For stone work, use non-staining mortar and grout.
- Minimize horizontal masonry surfaces.
- Avoid long continuous steel shelf angles. Fill 1/2 inch clearance with highly compressible "Styrofoam" to prevent mortar from entering clearance slot.
- Consider using reinforced masonry lintels in place of steel lintels.
- Only concave mortar joints will be allowed. Raked mortar joints are specifically prohibited.
- Provide continuous control joints as recommended by the Brick Institute Standards. Control joints are to be at the masonry head joints.
- Lintels to be hot dipped galvanized.
- Vent all cavity walls, top and bottom.
- All masonry openings are to be modular.
- The use of brick below finished grade is not allowed.

BUILDING STANDARDS

DIVISION 05 -- METALS

051200 STRUCTURAL STEEL FRAMING

- There are no unique University preferences regarding this Section.

055100 METAL STAIRS

- Pre-assembled steel stairs with concrete-filled treads are preferred.

BUILDING STANDARDS

DIVISION 06 -- WOOD, PLASTICS AND COMPOSITES

062000 FINISH CARPENTRY

- The use of exterior millwork should be limited to replacement and restoration work.

064023 INTERIOR ARCHITECTURAL WOODWORK

- Interior architectural woodwork shall be evaluated by the University and the User.

066116 SOLID SURFACING FABRICATIONS

- Epoxy resin countertops are required in corrosive environments.

BUILDING STANDARDS

DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

071000 DAMP-PROOFING AND WATERPROOFING

- For foundation walls, provide waterproofing system capable of withstanding a hydrostatic head for the depth of the foundation and provide a minimum 6-inch perimeter drain tile.
- Provide water dams at all critical foundation joints.
- Waterproofing for plaza decks should be a hot applied fluid system.
- Provide damp-proofing on the exterior surface of concrete foundation walls in contact with earth, when subsoil or subsurface moisture does not impose hydrostatic pressure at the damp-proofing plane, unless the inside space is unexcavated.
- Provide waterproofing and subsurface drainage of walls & below grade slabs when a basement is established below the normal groundwater level.
- Provide membrane waterproofing for the entire floor in toilet, shower rooms, and on floor slabs subject to hosing down with water where leakage would cause damage in rooms below.
- Line cast-in-place base of individual showers with a membrane type shower pan.
- Waterproof side walls of shower stalls to a minimum height of about 7 feet.

072100 THERMAL INSULATION

- There are no unique University Standards for this section.

072413 POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEMS

- EIFS Systems are not allowed.

072416 POLYMER-MOFIED EXTERIOR INSULATION AND FINISH SYSTEMS

- EIFS Systems are not allowed.

075000 MEMBRANE ROOFING

- Multi-ply membrane roofing systems are preferred. Systems can be either coal-tar bitumen asphalt or cold adhesive. Single-ply roof membranes are not recommended.
- Fume recovery is required on coal tar projects.
- Minimum "R" for roofing insulation is R=15.
- Asphalt kettles shall be equipped with afterburners.
- Factory mutual I90 requirements shall be met.
- Minimum factory warranty shall be 20 year, no dollar limit.
- All roof penetrations shall be spaced a minimum of 36 inches from each other.
- All curbs shall be a minimum of 16 inches above the roof deck.
- Roof mounted HVAC equipment shall be a minimum of 36 inches above the membrane surface (i.e., ductwork).

BUILDING STANDARDS

DIVISION 08 -- OPENINGS

081100 METAL DOORS AND FRAMES

- Exterior doors and frames are to be galvanized.
- Hospital stops should be used when health issues are present.
- All door frames are to be welded.
- Door labels are not to be painted.
- Hollow Metal Door:
    1. Standard Type: A (3 hour) Fire Label (UL Approved); B (1-1/2 hour) Fire Label (UL Approved); Non-Rated.
        a. 1-3/4 inch thick, seamless hollow construction.
        b. 18 gauge steel face sheets.
        c. Beveled edges.
        d. Polystyrene Insulation (Honeycomb for fire rated doors).
        e. All spot welds will be filled and ground smooth.
        f. 7 gauge (3/16 inch) thick by 1 1/2 inches wide by 6 inches long hinge and pivot reinforcements, with additional reinforcement welded to door face.
        g. 12 gauge lock hardware reinforcements.
        h. 14 gauge top and bottom reinforcement channels
        All surfaces to be painted (primed - gray) for rust resistance.
        i. Finished Sizes of Doors (Clearances): Jambs and Head - 1/8 inch; Meeting Edges, Pairs of Doors - 1/8 inch; Bottoms - 3/8 inch (no threshold or carpet), 1/4 inch (at threshold and 1/4 inch to top of decorative floor finish, except carpet), and 3/4 inch at areas to receive carpet.
    2. Type 1: A (3 hour) Fire Label (UL Approved); B (1-1/2 hour) Fire Label (UL Approved); Non-Rated. To match standard type door with these additional requirements.
        a. 18 gauge vertical stiffeners, 8 inches on center, spot welded to face sheet every 6 inches.
    3. Type 2: A (3 hour) Fire Label (UL Approved); B (1-1/2 hour) Fire Label (UL Approved); Non-Rated. To match standard type door with these additional requirements.
        a. 16 gauge steel face sheets
        b. 18 gauge vertical stiffeners, 8 inches on center, spot welded to face sheet every 6 inches.
- Hollow Metal Frames:
    1. 16 gauge steel full welded unit construction with corner mitered, reinforced, continuously welded full depth and width of frame (wider than 4'-0", 14 gauge steel)
    2. All welds are to be ground smooth; Frame is to be prime painted (gray) on all surfaces for rust resistance
    3. Anchors are to correspond with wall type; Frames 1'-0" to 3'-0" are to have 2 anchoring points (top and bottom); Frames 3'-0" to 7'-0" are to have 3 anchoring points (bottom, middle and top) on both door jambs; All frames taller than 7'-2" to be custom design by A/E with approval from FM. No reveal in basement and mechanical areas. All frames in masonry walls to fit modular openings.
    4. All anchors to be 14 gauge; bottom floor anchors to be attached by masonry screws.
- Door Hardware: Kickplate required on all doors.
    1. 18 gauge stainless steel kickplate, half door (non-rated door only).
    2. 8 gauge stainless steel kickplate, 14" x door width (less 1").
- At the Owner's discretion, any door can be selected for physical destruction to validate design criteria. Owner to replace if door meets design criteria.

081416 FLUSH WOOD DOORS

- Book match veneers on double doors.
- Provide a lifetime guarantee on all wood doors.
- Provide blocking for all hardware.
- Wood doors:
    1. Flush Door - Stave Lumber Core (SLC7 Bonded)
        a. Thickness - 1-3/4".
        b. Core - Low density, one species wood blocks glued together with Type II glue (21-27 PC).
        c. Veneer - Plain sliced red oak, pre-manufactured 3 Ply 1/8" plywood (veneer min. 1/50" thick).
        d. Styles - 1-3/8" minimum matching hardwood with veneer.
        e. Rails - 1-1/8" minimum, with matching hardwood with veneer.

f. Standard - AWI Section 1300; ANSI/NWWDA I.S.1-A.
g. Warranty - One (1) year replacement.
h. Blocking - All necessary hardwood blocking for closer, lock, and hinges.
i. Machining - Pre-fit, bevel, lock and hinge mortise.

083100 ACCESS DOORS AND PANELS

- Access doors and frames shall be metal.
- Access door shall be 10"x10" minimum and lockable.

083113.53 'FIRE-RATED' SECURITY ACCESS DOORS AND FRAMES

- Subject to compliance with requirements, provide products by one of the preferred manufacturers:
  1. Diebold, Incorporated.
  2. Mosler Inc.
  3. Schwab Corporation.
- Combination Lock: UL 768, Group 3-tumbler, mechanical type, capable of not less than one million possible combinations; equipped with UL 140 relocking device that automatically locks bolt when lock is subjected to mechanical attack.

083613 SECTIONAL DOORS

- Overhead doors shall be "high lift" type wherever possible.
- Track shall be 3" deep and 11 gauge thickness.
- Provide take-up reel and pneumatic safety edge for electrically operated doors.
- Sectional overhead doors are to be insulated and gasketed to impede all infiltration.

084113 ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

- The door thickness is to be 1-3/4". Right and left strikes, top and intermediate rails are to be 6" wide. The bottom rail is to be 10" wide. Provide reinforcement for all hardware, including closures.
- Bottom rail should be maximum 10" (ADA).
- Use tie rod construction.
- Minimum 1/8" (0.98-0.125") wall thickness for door.
- Use continuous gear hinges.
- Solid tube door jamb with reinforcing at the strike.
- Refer to Section 087000 for door hardware.

084126 ALL-GLASS ENTRANCES AND STOREFRONTS

- Preferred for interior use only.

084229.23 SLIDING AUTOMATIC ENTRANCES

- Door (construction): Tubular frame members (clear anodized aluminum) fabricated with mechanical joints using heavy duty inserted reinforcing plates and concealed tie-rods or j-bolts.
  1. 4" mid rail.
  2. 10" bottom rail.
  3. 6-1/2" top rail.
  4. Glazing - safety laminated ¼" clear.
- Door Operator: Use product specification from The Stanley Works or equal (AAADM and ADA compliant).

084229.33 SWINGING AUTOMATIC ENTRANCES

- Door (construction): Tubular frame members (clear anodized aluminum) fabricated with mechanical joints using heavy duty inserted reinforcing plates and concealed tie-rods or j-bolts.
  1. 4" mid rail.
  2. 10" bottom rail.
  3. 6-1/2" top rail.
  4. Glazing - safety laminated ¼" clear.
- Door Operator: Use product specification from The Stanley Works or equal (AAADM and ADA compliant).

084233 REVOLVING DOOR ENTRANCES

- Units to manually operate unless ADA required.
- Manufacturer standard sized per design requirements.
- Locking devices (2 each per opening) should be similar to: CRANE CRD 12 or International Steel #3800550.
- Use same finish as building hardware finish.
- Door construction and operator: Use product specification Besam Automated Entrance Systems or equal (AAADM and ADA compliant).

085113 ALUMINUM WINDOWS

- Solid aluminum windows are required.
- Aluminum clad wood windows are not allowed.
- All windows shall be double glazed.

087000 HARDWARE

- Refer to each numbered building file (request from Project Manager) and the University's Facilities Management Lockshop.
- Hardware:
    1. Locksets
        a. Locksets shall be provided with a lever handle design as required by code.
        b. Inside lever shall retract latchbolt, and also deadbolt if so equipped.
        c. Locksets shall be provided with an auxiliary latch to deadlock latchbolt.
        d. Locksets provided shall have a 3/4" latchbolt.
        e. Locksets provided with a deadbolt shall have a 1" throw bolt.
        f. Locksets provided for doors into stairs or entrances to vehicular traffic areas, or other hazardous areas, for example. Elevator pits, electrical switch rooms, shall have a change in texture either by knurling or applying an abrasive finish to the lever.
        g. Locksets provided for office doors shall have stops in the face of the lock, or a turn button on the inside lever, to lock and unlock outside lever. (entrance function)
        h. Locksets provided for laboratories and classrooms should not have stops in the face of the lock. Latch bolt shall be operated by levers from either side of the door except when outside lever is locked by a key in the outside cylinder. (classroom function)
        i. Locks provided for public washrooms shall be similar to the Yale #314 ¼ ST. A double cylinder deadbolt with a thumb turn on the inside of the room that will allow the deadbolt to be retracted, but not thrown. Push plates and pulls are also required.
        j. Locks provided for private washrooms shall be similar to the Yale 8702 FL series.
        k. Lever centerline shall be 39 5/16" off of finished floor.
        l. Provide curved lipped strikes for all mortise locksets.
    2. Panic Bars/Exit Devices:
        a. Exit devices similar to the von Duprin #99 series shall be provided on exterior doors.
        b. Function of the device shall be determined by the UIC project coordinator according to the planned usage of the opening. Eg., exit only, night latch, electric latch retraction, etc.
        c. Outside trim of exit devices shall be provided with lever handles similar to the von Duprin #992 with 06 lever for the #99 series device.
    3. Electric Strikes:
        a. Provide electric strikes similar to the Folger Adams #712-75 24 DC n.f.s. for metal jamb applications when a mortise lockset is to be specified.
        b. Where a pair of doors with a mullion are called for, use of an electric strike similar to the Folger Adams #310-4 24 VDC n.f.s. is called for.
    4. Shear Locks:
        a. Provide shear locks with no less than 1,000 lbs. Holding force similar to the von Duprin #700 series.
        b. Provide a remote light kit to indicate the status of the shear locking system.
    5. Flush Bolts:
        a. Provide flush bolts similar to Ives FB458.
        b. Where automatic flush bolts are required, provide flush bolts similar to Ives FB-31 P.
    6. Coordinators:
        a. Where one door in a pair of doors needs to be closed first, provide door coordinators similar to the Glynn-Johnson COR series.
        b. If, because of the lack of space due to door closer arms or vertical rod exit devices, the COR series coordinator cannot be used, provide a coordinator similar to the Glynn-Johnson COR65 or COR85.
    7. Door Closers:
        a. Door closers concealed in the floor should not be used for exterior doors exposed directly to the weather. Surface mounted door closers similar to the LCN 4041 regular arm series are preferred. Under no condition should door closers be mounted on the outside of exterior doors. Do not use parallel arm door closers on exterior doors.
        b. Door closers concealed in the floor similar to the dor-o-matic 2500-2600 series may be used for exterior and vestibule doors

protected from the weather.
   c. For interior doors, surface mounted door closers similar to the LCN 4041DEL regular arm series are preferred. Use of non-handed and size adjustable closers are preferred. Do not use corner brackets or drop plates unless no other means of attachment is available.
   d. Door closers similar to LCN 4630 and 4640 series auto-equalizers, electrically powered shall be used for automatic operation on dedicated handicap entries.
   e. Use hold open arms only where it is necessary to keep the door opened and only when they are allowed by code. Use of electro-magnetic holders for fire doors that can be tied to the fire alarm system similar to the Rixson 900 series 120VAC are preferred.
   f. Door closers should be provided on doors to exterior, stairs, toilet rooms, kitchens, dining rooms, lecture rooms, and other doors to public areas, and where control is required by fire, safety and building codes. Avoid unnecessary use of door closers. All metal bucks and metal doors shall be reinforced for surface mounted door closers, weather closers are specified or not.
   g. Door closers shall be mounted on the secured side of space.
8. Electro-Magnetic Holders
   a. Provide electro-magnetic holders similar to the Rixson 900 series. Provide holders only when required by code or requested by the using agency and allowed by code.
   b. Provide manual switch in system of fire door holders to permit closing of all doors from one point without sounding alarm.
9. Kick Plates
   a. Provide stainless steel kick plates on doors that are subject to high frequency usage.
   b. Generally doors to exterior, stairs, toilet rooms, storage, receiving, library, and kitchen and dining rooms should have kick plates.
   c. Kick plates on one side of door are sufficient unless traffic flow is great enough to warrant use on other side of door also.
   d. Provide kick plates on both sides of a double acting door.
10. Push/Pull Plates and Latches
   a. Provide push plates similar to the Rockwood 70RC series.
   b. Provide push / pulls on toilet doors similar to the Rockwood 107 x 70C x 70C series.
   c. Provide back plates behind all pulls.
   d. Provide hospital push / pull latches similar to Glynn Johnson HL-6-5" BL.
11. Hinges/Pivots
   a. Provide continuous gear type hinges similar to Roton 780HD series on exterior doors.
   b. Provide stainless steel, concealed ball bearing hinges with non-removable pins on exterior doors if a continuous gear type hinge is not used.
   c. Brass hinges shall never be used on fire rated or labeled doors.
   d. The standard hinge size shall be 4-1/2 x 4-1/2. On doors over thigh or 3' wide, or with very heavy traffic flow provide 2 pairs of 4 1/2 x 4 1/2 hinges.
   e. Use of electric power transfer hinges similar to Stanley CEFBB179-56 are preferred over the use of door cords.
   f. Where power must be transferred on openings with pivots, provide a electric transfer pivot similar to the Glynn-Johnson EPT-3P series.
12. Door Bumpers/Stops
   a. Provide heavy duty cast wall bumpers similar to the Ives WS-402-CVX.
   b. Provide heavy duty cast dome type floor stops similar to the Ives FX-436.
   c. Where wall or floor stops cannot be used on interior doors, provide a holder similar to the Glynn-Johnson GJ100 series for concealed application. Provide a holder similar to the Glynn-Johnson GJ900 series for surface mounted holders.
13. Rubber Silencers/Muters
   a. On metal door frames provide a minimum of 3 resilient rubber silencers.
14. Thresholds/Sweeps
   a. Maximum threshold height shall be 1/2" as required by code and in keeping with ADA.
   b. All exterior door openings shall be properly weatherized to control infiltration of outside elements.
15. Finishes
   a. All finish hardware shall match existing hardware in the

surrounding area of the project.
   b. If in doubt, consult the UIC project coordinator to determine the correct finish.

16. Keying
   a. Medeco biaxial lock cylinders are an approved sole source item for the UIC campus. Supplier to meet with owner to determine requirements and obtain final instructions. Medeco shall deliver lock cylinders and key blanks to owner for keying and installation.
   b. Keying and installation of all lock cylinders will be done by the UIC Facilities Management Lockshop. Provide 3 key blanks per lock cylinder.
   c. All lock cylinders shall be Medeco biaxial cylinders with patented keyway specified by owner.
   d. Owner will provide a letter of authorization to Medeco Security Locks, Inc. for supplier to purchase material that will be drop shipped to owner.
17. Security/Control
   a. Construction keys or key blanks must be kept and/or used with great control while project is underway.
   b. All key blanks supplied for the project shall be turned over to the UIC physical plant lockshop along with a letter of transmittal.
   c. In many cases, temporary keys may be needed to access mechanical areas near the project. These keys are issued by the lockshop to the UIC project coordinator for distribution and must be returned upon completion of the project or when requested by the UIC project coordinator.
   d. All keys for switches, elevators, alarms, panic devices, access panels, lockers, desks, drawers, etc. Shall be turned over to the UIC physical plant lockshop by the UIC project coordinator with a description of their location and use along with a letter of transmittal.
18. Templates/Maintenance Manuals
   a. Upon completion of the project, all templates, instruction booklets and preventative maintenance manuals will be turned over to the physical plant department by the UIC project coordinator along with a letter of transmittal.
19. Walk-Thru/Punch List
   a. Upon completion of the project, a walk thru will take place with physical plant personnel to develop, if necessary, a punch list of items that need to be addressed before the UIC will consider the project finished.
   b. For finish hardware, personnel from the carpenter shop and the lockshop will be included in this walk thru.
18. Follow-Up/Completion
   a. All items listed in the punch list shall be addressed in a timely fashion.
   b. No job will be considered finished as long as punch list items exist.
   c. All items left over after completion of project (eg., closers, locks, levers, rosettes, bumpers, plates, screws, etc.) shall be turned over to the physical plant department by the UIC project coordinator along with a letter of transmittal.

088000 GLAZING

- Materials
   1. Wire Glass: Use wire glass wherever fire resistance or vandalism is a factor. Diamond mesh is preferred.
   2. Safety Glass: Use safety glass when required by the glazing act and other applicable codes.
   3. Obscure Glass:
      a. Obscure glass or diffusing glass shall be used in all toilet room windows. Verify with the University whether obscure glass should also be used in doors to offices, laboratories, and classrooms
      b. Obscure glass shall be selected from standard patterns available from several manufacturers so that replacements may be made to match remaining materials.
   4. Float Glass: Type A Glazing: FS DD-G-45; clear, double strength, 1/8" thick.
   5. Insulating Glass: Hermetically sealed double glazed units: Sigma #65-7-2; outer and inner panes of 1/4" thickness minimum glass, float quality; minimum overall thickness 1", low-E and argon filled.

089000 LOUVERS AND VENTS

- All exterior louvers to have insect screens.

- Architectural and mechanical louvers shall be specified in Section 233700 (Air Outlets and Inlets), and placed in mechanical contractor's contract.

BUILDING STANDARDS

DIVISION 09 -- FINISHES

095123 ACOUSTICAL TILE CEILINGS

- Provide 2 x 2 lay-in system for new installations.
- Match existing ceiling system for repairs and renovations.
- No tile is to be less than 12" in width or length.
- Provide a dropped soffit at transition areas to maintain symmetrical layout. Drop soffits a minimum of 1" below ceiling grid.
- Suspend ceiling system from structural members or floor decking only. Do not attach to roof deck.

095133.13 ACOUSTICAL SNAP-IN METAL PAN CEILINGS

- Are only to be used to match existing conditions.

096400 WOOD FLOORING

- The University would prefer not to use wood flooring other than for athletic and performing arts facilities.

096466 WOOD ATHLETIC-FLOORING ASSEMBLIES

- The University prefers to use maple, strip flooring on fixed, wood sleepers and sub-floor.

096516 RESILIENT SHEET VINYL FLOORINGS

- The University prefers to install Mannington sheet vinyl floor covering.

096519 RESILIENT TILE FLOORING

- The University prefers to use vinyl composition tile (RTF).
- "Fritztile" or similar, is not allowed.
- Vinyl base to be standard colors of black, gray or brown from continuous rolls with preformed corners.

096613 PORTLAND CEMENT TERRAZO FLOORING

- Precast terrazzo is preferred for large areas.
- Bonded acrylic epoxy terrazzo is preferred.
- Terrazzo is the preferred flooring in toilet rooms.
- During renovation the color and style is to match existing terrazzo finishes.
- Concrete base control joints to align with terrazzo pattern.
- Samples to be submitted within 30 days of Notice to Proceed.
- Use control joints at all columns.

096813 TILE CARPETING

- Broadloom carpeting is preferred. Carpet tile will be considered.

096900 ACCESS FLOORING

- Access flooring shall be coordinated with Americans with Disabilities Act (ADA) to include ramps, steps, rails and doors.

097200 WALL COVERINGS

- There is no University preference for this Section.

099100 PAINTING

- Mechanical and Electrical Equipment:
    1. Flexible connections between ventilating fans and ducts shall not be painted. Valve stems and other close fitting mechanical and moving parts shall not be painted. Nameplates on motors and other mechanical equipment shall not be painted.
    2. All fire alarm system raceway, conduits, juntion boxes, and terminal boxes shall be of red color or shall be painted red
- Painting and Finishing Schedule:
    1. The choice of all finishing material shall be based on durability in wear and cleaning.
    2. Concrete Masonry Units: Brush or roller painting is preferred with block filler applied first. Lightweight concrete block may be spray painted, provided coverage is the same as brushing.
    3. Wood Doors: Natural or light colored finishes should not be used on wood doors or wood base because such finishes are easily discolored or damaged from foot traffic and floor cleaning operations.
    4. Equipment Rooms: Painting may be omitted on walls and ceilings in

mechanical equipment rooms.
5. Telecom Rooms must be painted or sealed.
6. The University prefers an eggshell to semi-gloss finish. A flat finish is not acceptable.

- Protection:
  1. Provide adequate ventilation particularly when painting on buildings which remain user-occupied
- The University prefers to use low VOC paints.

BUILDING STANDARDS

DIVISION 10 -- SPECIALTIES

101300 DIRECTORIES

- Internally illuminated directories are preferred and must be key locked.
- Bulletin boards are to be self-healing fabric wrapped with aluminum edge framing.

101400 SIGNAGE

- Refer to the University's "Campus Interior Signage Program" manual.
- Graphic Process:
    1. Permanent identification:
        a. Letters, numbers and symbols to be permanently bonded and raised a minimum of 1/32" from the smooth background.
        b. Grade 2 Braille characters to appear in accordance with Accessibility Regulation, with reference to position, size and configuration. Characters to have smooth edges, as opposed to edges that are sharp.
        c. Acceptable graphic processes listed below from most to least desirable will provide photomechanical and/or computer-generated graphic processes to be selected from only one of the following:
            i. Photo-etch nylon-polymer with metal substrate.
            ii. Chemical or Acid etched metal.
            iii. Cast metal.
            iv. Photo-sandblast metal or plastic.
            v. Plastic engraving.
        d. Sign panels and frames will be fabricated in accordance with drawings included as part of the documents for this project.
    2. Changeable or temporary identification:
        a. Message to be applied to the face of the removable insert.
        b. Computer-cut vinyl, photo-screen print process, or paper inserts produced on a laser writer are acceptable.
    3. Ceiling and/or projecting sign panels:
        a. Computer-generated vinyl die-cut characters or photo-screen process applied to the face will be acceptable.
        b. Number of faces (single or double) will be determined by location and message schedule.
- Fabrication:
    1. Typeface:
        a. Helvetica-Black, Helvetica-Medium, or Times Bold with layout per drawings. Inserts may utilize upper and lower case. See representative typeface in "Exhibit 7."
        b. Capital letter height minimum of 5/8" for permanent identification.
    2. Permanent identification:
        a. One-eighth-inch (1/8") to 3/16" panel thickness, plus raised image graphics, with square corners and edges for room number and name with 1/16" panel thickness for symbols and directional panels.
        b. Panel to be fastened by means of double-face foam tape applied to the back of each panel.
    3. Changeable or temporary identification:
        a. One-sixteenth-inch (1/16") matte acrylic faceplate with screen printed border, second surface, assembled with spacers and a 1/8" back plate with .025" minimum spacer thickness to allow for insert.
        b. One-hundredth-of-an-inch (.010") clear polished vinyl, for changeable insert with graphics applied to face or paper inserts produced on a laser writer in accordance with specifications will be acceptable.
        c. Holder affixed by means of metal foil on back of holder with magnet applied to hardboard within aluminum perimeter frame.
    4. Hazardous material holder:
        a. One-sixteenth-inch (1/16") matte acrylic faceplate with screen printed border, second surface, assembled with spacers and a 1/8" to 3/16" back plate with .025" minimum spacer thickness to allow for insert.
        b. Panel to be fastened by means of double-face foam tape applied to the back of each panel.
    5. Ceiling and/or projecting sign panels:
        a. Refer to architectural drawings, comments within message schedule d field conditions to determine installation requirements.
        b. Panel material to be acrylic or aluminum panel as indicated in project documents.
    6. Frame:
        a. One-sixteenth-inch (1/16") x 1/2" aluminum angle perimeter, with pressboard back, square corners and counter-sunk holes for installation for room name and number; 1/16" x 3/8" aluminum angle for symbol and wall mounted directional panels.
        b. Frame size to be a minimum of 1/8" and maximum of 1/4" larger than the sign panel, in both height and width to allow for a reveal between panel and frame.

c. Frame to include 1/16" aluminum divider between number and function panels, or as indicted on the Drawings.

7. Colors:
   a. Unless specified elsewhere, contrasting colors for graphics, background and frame will be selected from manufacturer's standard assortment of colors.
   b. For specific match, owner/administrator will provide color swatch, minimum 4" x 4", and sign fabricator will provide sample for approval.
8. Panel size:
   a. Refer to Drawings for all dimensions:
   b. Should message schedule include graphic copy that exceeds specifications indicated, panel size to be increased accordingly; but, field conditions to be verified for sufficient space to accept sign panel.
9. Braille location:
   a. Center justify under room numbers.
   b. Left justify under room identification or other text.

- Acceptable Vendors:
  1. Manufacturers/distributors providing products, subject to compliance with the plans and specifications of this project, will be considered.
     a. Vendors
        i. Architectural Compliance Sign Co.
        ii. Matthews
        iii. Nelson-Harkins
        iv. Pobolocki Sign Systems
        v. Pryor Architectural Signage
        vi. Spanjer
        vii. Spring Moon Signs & Designs
     b. The University will consider written request to add vendors to the above list upon receipt of product literature and one (1) sample similar to the components specified for this project, and no less than ten (10) days prior to the scheduled bid opening date. Approved requests will be included in the addenda form not less than seven (7) days prior to the bid opening. Requests received less than ten (10) days before the scheduled opening will not be considered.
- Installation:
  1. Sign panels, components and frames to be located as shown or scheduled, affixed by means of the mounting methods described, in accordance with the manufacturer's instructions.
  2. Sign frames and panels to be installed on the latch side of the door, identifying room name and/or number, 2" to 3" from the door jamb and at a height of 60" to the center of sign panel as measured from the floor level, or in accordance with the current ADA Accessibility Guidelines.
  3. Hazardous material information holder to be installed below sign frames and panels.
  4. Directional signs to be centered within visual area.
  5. Projecting and ceiling mounted sign panels will have a minimum clearance of 7'-6" from floor level to the bottom of the sign panel.
  6. All components to be installed level and plumb with all packing material and debris to be disposed of in a manner agreeable with the Owner/Administrator.
- Sign Schedule:
  1. Refer to message schedule included with the architectural plans for this project.
  2. Fabrication contract will be responsible for duplicating messages as presented, in the quantities indicated.
- Cleaning and Protection:
  1. Upon completion of the installation, soiled sign surfaces to be cleaned in accordance with manufacturer's instructions.
  2. Damaged items will be reported to the owner and manufacturer, with replacement in a prompt and timely manner.
- Catalog of Signs:
  1. Type 1 - Room Number
     a. 1a - 3" x 3" panel
     b. 1b - 2" x 6" panel
     c. 1c - 3/4" vinyl die-cut characters applied to the door jamb (frameless).
  2. Type 2 - Number and Room Name
     a. 2a - 3" x 3" panel (number) with 3" x 9" panel (room name).
     b. 2b - name and number above second 3" x 9" panel with 3" x 3" pad of "Post-It" Notes below number panel.
     c. 2c - Room name, with panel sized in accordance with building conditions, mounted above door or from ceiling at entry (frameless).
  3. Type 3 - Number and Faculty Identification
     a. 3a - 3" x 3" panel (number) with 3" x 9" changeable insert holder available with single or double slots.
     b. 3b - 3" x 3" panel (number) with 3" x 9" panel (room name) in top half with 3" x 9" changeable insert holder (single or double slot) and 3" x 3" "Post-Its" below.
     c. 3c - Similar to above, except changeable insert holder replaces room name to right of number.

4. Type 4 - Conference Room Identification
    a. 4a - 3" x 3" panel (In Use) with 3" x 9" panel (room name) as slide to cover (In Use) when room is vacant.
5. Type 5 - Symbol with Message
    a. 5a - 6" x 9" panel (men, women, stairs, etc.)
    b. 5b - 9" x 9" panel (area of rescue assistance)
    c. 5c - 9" x 9" panel (symbol with right angle mount)
    d. 5d - 10-1/2" x 10-1/2" panel (accessible entrance)
6. Type 6 - Floor Level Identification (located inside stairwell)
    a. 6a - 6" x 6" panel
7. Type 7 - Elevator Warning (in case of fire…)
    a. 7a - 9" x 9" panel
8. Type 8 - Safety Hazard Identification (fire door, not an exit, employees only)
    a. 8a - 3" x 9" panel (no drawing attached.)
    b. 8b - 4" x 9" panel (no drawing attached.)
9. Type 9 - Directional, Wall Mount
    a. 9a - Panel with height and width determined by message length, with all panels of same width, unless space conditions create a limit.
    b. 9b - Individual changeable insert panels with size based on letter height and message length all inserts within building should be of same size to allow for changing individual message panel.
10. Type 10 - Directional, Ceiling Mount
    a. 10a - Single panel with vinyl die-cut characters applied to face with size and number of faces determined by conditions within the building.
    b. 10b - Individual changeable insert panels with die-cut vinyl copy to allow for changing individual messages. (No drawing attached.)
    c. Refer to comments for installation may be rigid or by chain.
11. Type 11 - Directory
    a. 11a - Primary directory at entrance. Size, style (insert strip of letterboard) and type (illuminated/non-illuminated) to be based on specific needs of building. (No drawing attached.)
    b. 11b - Secondary directory in elevator lobby of each floor.
    c. To be similar to above, only smaller to accommodate floor information.
12. Type 12 - Emergency Evacuation (Floor Plan)
    a. 12a - Customized for each building based on complexity - located at each elevator lobby to identify complete floor layout. (No drawing attached.)
    b. 12b - Located in corridor at stairs to identify alternate routes to safety, not necessary to reproduce complete floor plan. (No drawing attached.)
13. Type 13 - Hazardous Material Information Holder (Frameless)
    a. 13a - Changeable 3 slot (6-1/2" x 14") holder to accept NRC, OSHA, etc., approved information cards.
14. Type 14 - Building Details for Police/Fire
    a. 14a - Floor plans to detail various zones for water, smoke, etc. (No drawing attached.)
15. Type 15 - Stack Signage with Changeable Inserts
    a. 15a - 3" x 9" changeable insert holder, double slot, perpendicular or triangular mount.
16. Type 16 - Directory with Changeable Inserts
    a. 16a - 3" x 18" panel, 15" x 15" changeable insert holder.
17. Type 17 - Suite Identifier

- Typeface: Helvetica-Black, Helvetica-Medium, or Times Bold (permanent identification), upper and lower case (changeable identification) with size and layout per Drawings.
- Frame: 1/16" aluminum angle for perimeter with square comers and dividers, and/or slide as indicated on Drawings.
- Installation: Frame mounted to wall/ceiling by means of concealed mechanical fasteners (screws) through frame and into anchors set in pre-drilled holes with panel affixed by means of double-face foam tape (permanent identification) or magnet for changeable insert holders or message panels.
- Laboratory Signage Guidelines
    1. General Requirements:
        a. Intent:
            i. The primary purpose of the University of Illinois at Chicago (UIC) Laboratory Signage Guidelines is to provide uniform and accurate emergency information to first responders such as fire and police personnel. A secondary purpose for the laboratory signage is to provide identification and contact persons for Environmental Health and Safety Office (EHSO) personnel, Operations and Maintenance workers and others needing this Information during normal business hours.
            ii. The Laboratory Signage Guidelines are specific in some areas and very general in others so that certain minimum information is absolutely provided yet special hazards in a laboratory can be included in the laboratory signage
            iii. The standardization of laboratory signage can represent an economic savings to the Campus, and will help to reduce unfavorable aesthetics in the corridors of Campus buildings. In

addition, standardization of the information format and content will reduce potential health and safety hazards of Campus and community emergency personnel, and UIC staff.

iv. The laboratory signage will allow updating of information to be simple and uncomplicated.

v. The laboratory signage will perform basic functions to inform persons of special hazards in a laboratory, identify emergency contact personnel and meet regulatory requirements.

vi. Use UIC Environmental Health and Safety Standard 3-2-5, Laboratory Hazard Identification.

b. Scope:

i. Laboratories which meet the UIC Model Chemical Hygiene Plan definition of "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis" will be required to follow these Laboratory Signage Guidelines.

ii. Chemical storerooms shall utilize the Emergency Contact Card (explained in Part 2.a.) and shall have as one of the other inserts an identification sign indicating that the room is a chemical storage area.

iii. Non-chemical laboratories that could present a health or safety hazard to emergency personnel, e.g., high voltage laboratories, are included in the scope of these guidelines.

iv. Other areas where it would be beneficial to have a list of persons to contact in the event of an emergency, such as instrument or computer rooms, may use the Emergency Contact Card.

c. Responsibilities:

i. Individual departments will be responsible for ensuring that the basic laboratory signs are utilized and updated on at least an annual schedule. This responsibility may be given to the individual laboratory supervisors who may obtain assistance from DEH&S upon request. Updates or replacement of signs during the interim should be initiated by the laboratory supervisor.

ii. DEH&S will assist in ensuring that the Campus comply with the Laboratory Signage Guidelines by sending out annual notices each September to the various Campus units reminding them to update their signage. In addition. DEH&S will report any deficiencies in the signage found during routine activities to the lab supervisor, relevant safety committee or to the unit head.

iii. DEH&S Health Physics personnel shall be responsible for radiation hazard signage. DEH&S Biological Safety personnel shall be responsible for biohazard signage.

iv. Extraneous material posted on entrance ways greatly detracts from the effectiveness of laboratory signage and will not be permitted. Hence, departments will be responsible for the removal of extraneous postings on lab doorways which detract from the laboratory signage.

- Design Requirements for Changeable Inserts

1. General Information

a. The size of the inserts shall be 4" X 6" such they can be inserted into the three pockets of the 14" x 6-1/2" sign.

b. The inserts will be made of paper or cardboard and placed in a frame such that the inserts are removable from the frame. The Emergency Contact Card will be easily removable so that a person can take the insert to a safe location to read and utilize the information. The radiation and biological hazard inserts may be less readily removable.

c. If colored paper is used for the Emergency Contact Card and/or any other insert, it shall not interfere with the recognition of other inserts, e.g., the yellow and magenta radiation inserts.

d. The Emergency Contact Card shall be updated annually, generally at the beginning of every school year, and immediately in the event of a change in information. Radiation hazard inserts shall be posted and removed only by the DEH&S Health Physics personnel. The biohazard inserts shall be posted and removed only by DEH&S Biological Safety personnel.

e. Examples of Special Hazards Inserts are available from DEH&S. If used, these must be reviewed at least annually and updated immediately in the event of a change in information.

2. Emergency Contact Card.

a. The Emergency Contact Card shall include the information listed in this section and shall be formatted as similar as possible to Figure 1 of this document Figure 1 is available in electronic or written format from DEH&S.

b. The Emergency Contact Card shall be placed in a frame such that it is easily removable. In the three pocket frame, this insert shall reside in the middle pocket.

c. Required Information:

i. "IN CASE OF EMERGENCY CONTACT 9-911".

ii. Room number.

iii. Department name.
iv. Laboratory supervisor name, office location, office phone and home phone.
v. Two to four emergency contacts with office location, office phone and home phone.
vi. An indication whether there are local alarms in the lab, and an explanation of the alarms.
vii. At least two blank lines shall be provided for the description of any special hazards information, e.g., Poison A gases, hydrogen cylinders.
viii. Preparer's name or initials.
ix. The date the sign was completed.
x. DEH&S phone number, 3-2755.

3. Special Hazards Inserts:
   a. The Special Hazards Inserts shall contain information which is necessary to either convey hazard information to emergency personnel who may need to enter the lab, or to satisfy regulatory requirements.
   b. Certain Special Hazards Inserts may be required if determined necessary by the UIC Fire Department. These hazards shall consist of unusual health or fire hazards in a laboratory. The Fire Department shall work with the individual department in posting and updating such signs.
   c. DEH&S shall provide guidance on the use of optional inserts, including examples of special hazards inserts. For samples contact Department of Environmental Health and Safety.
4. Radiation Hazard Signage:
   a. Only DEH&S Health Physics personnel are authorized to post radiation hazard inserts.
   b. All "Caution Radioactive Materials, "Caution X-Ray", "Caution Radiation Area" and "Caution High Radiation Area" inserts and signs will be posted in accordance to applicable regulations found in 10 CFR Parts 19-20 and 32 Illinois Administrative Code: Chapter II, Subchapter 340. These inserts and signs shall be posted at the entry to the designated room or area and must be legible at ten feet.
   c. The Illinois Department of Nuclear Safety KLA.000.01 sign (i.e., the radiation workers right-to-know sign) must be "posted so as to be readily observable in the work place"; however, the sign should not be placed on the corridor door such that its presence detracts from other laboratory signage.
   d. The UIC radiation emergencies call list and the radiation emergencies procedure poster should be posted inside the laboratory, not on the corridor door.
5. Biological Hazard (Biohazard) Signage:
   a. The use of the biohazard insert shall be controlled by the Division of Environmental Health and Safety. Only DEH&S Biosafety personnel are authorized to post biohazard inserts. The biohazard inserts shall be posted in accordance with the requirements of 29 CFR 1910.45 and the guidelines published in the Federal Register, Volume 41, Number 131, page 27927.
   b. Biohazard inserts, specified herein, shall be used to signify the actual or potential presence of a biohazard. These inserts shall be posted at the entrance(s) to rooms or areas to signify the actual or potential presence of a biohazard. This posting shall serve as notice that the equipment, containers, materials, experimental animals, or combinations thereof, in the posted room, contain, or are contaminated with, viable hazardous agents.
   c. Biohazard inserts shall bear the biohazard symbol, the word "BIOHAZARD", and other information as required by the UIUC Committee on Biological Safety. The biohazard symbol shall conform to the symbol configuration shown in 29 CFR 1910.45. The biohazard symbol shall be designed and proportioned as illustrated in the Federal Register, Volume 41, Number 131, page 27927. The word "BIOHAZARD" shall be readable at a minimum distance of five feet.

101426 POST, PANEL/PYLON SIGNAGE

- Refer to the University "Campus Exterior Signage Program" manual.

102113 TOILET COMPARTMENTS

- This Standards Section includes University preferences on toilet compartments and screens as follows:
  1. Type: Steel, powder coated finish.
  2. Type: Stainless steel.
  3. Type: Solid-plastic, phenolic core.

4. Type: Solid-plastic, polymer resin are not to be used.
5. Compartment Style: Ceiling hung are required with steel support above.
6. Screen Style: Floor and ceiling anchors are required.

102813 TOILET ACCESSORIES

- Soap, toilet tissue and paper towel dispensers shall be provided by the University and installed under contract.

104400 FIRE PROTECTION SPECIALTIES

- Fire extinguishers, cabinets, and fire extinguisher location signs shall be supplied through the project. Fire extinguishers shall be located so that travel distance is no more than 75 feet with normal hazard and 50 feet with high hazard conditions. Fire extinguisher shall be of a dry chemical type and have a U. L. rating of 10A-60B:C. Cabinet sized to hold type of fire extinguisher; recommended recessed into wall. Fire extinguisher sign should be a projecting wall type installed above the cabinet.
- All new and remodeling projects shall require new fire extinguishers.

105113 METAL LOCKERS

- Wardrobe lockers shall be ventilated.
  1. Single tier and double tier.
- Athletic lockers shall be ventilated.
  1. Single tier or double tier.
- End panels shall be ventilated. Back panels are to be solid.
- Locker benches shall have prefinished wood seating.
- Expanded metal locker shall not be used.
- Lockers are to be designed for a hasp lock to be supplied by user.
- All lockers will set on field constructed masonry bases.
- Locker numbers shall be designated by the University.

107500 FLAGPOLES

- Flagpoles are to have a bronze anodized finish with internal cable with a gold anodized ball on top. Poles are to be 30' or 60' above ground. Height of the pole to be determined by the University. Each installation to have 3 poles unless directed otherwise by the University. Foundation and mounting as per manufacturer's requirements.
- Provide bronze recessed exterior 250w metal halide composite uplight flagpole lighting fixtures with mogul bases. One fixture per pole. Greenlee lighting CDB Series are preferred.

BUILDING STANDARDS

DIVISION 11 -- EQUIPMENT

111200 PARKING CONTROL EQUIPMENT

- This Standards Section should include University preferences on the following:
  1. Automatic barrier gates.
  2. Vehicle detectors.
  3. Traffic controllers.
  4. Ticket dispensers.
  5. Access control units.
  6. Central pay stations.
  7. Fee computers and printers
  8. Fee indicator.
  9. Exit terminals/verifiers.
  10. Parking facility management software.
  11. Lot full sign.
  12. Sirit antennas and processor boards (hands-free).
  13. Parking attendant booth.
  14. Fiberglass gate arms.
  15. Signage.
- Parking control system shall be used for transient, monthly, and/or special-event parking.
  1. Transient Parking: Hourly rated parking, with fee paid while [entering]exiting.
  2. Monthly Parking: Monthly rated parking, with fee paid by the month and entry gained by access control card.
  3. Flat-Rate Parking: Unlimited-duration, daily parking, with fixed fee paid when entering and free exit.free gate entry and fixed fee amount paid while exiting.
  4. Special-Event Parking: Duration-of-event parking, with fee paid while entering with gates up or down.
- Electrical System Roughing-in: Coordinate layout and installation of parking control equipment with connections to power supplies perimeter security system and security access control system.
- Provide extra gate arms: Two (2) breakaway gate arms for each gate installed, complete with accessory components. We do not use the breakaway gate arms.
- Subject to compliance with requirements, provide products by one of the following preferred manufacturers:
  1. Parking Control Equipment:
     a. Federal APD, Inc.
     b. Intellichip Technologies.
     c. Intertex Companies.
     d. Link Door Controls, Inc.
     e. Magnetic Automation Corporation.
     f. Operator Specialty Company, Inc.
     g. Parking Products, Inc.
     h. Sentex Systems.
     i. TCI Sales, Inc.
     j. Trafodata.
     k. Traf-Park Inc.
     l. WPS North America Inc.
     m. Zeag North America Inc.
  2. Traffic Controllers:
     a. Delta Scientific Corporation.
     b. Engineered Parking Systems, Inc.
     c. Intertex Companies.
     d. Parking Booth Company, Inc.
     e. Parking Products, Inc.

111300 LOADING DOCK EQUIPMENT

- This Standards Section should include University preferences on the following:
  1. Dock bumpers.
  2. Dock levelers.
  3. Truck restraints.
  4. Dock shelters will be considered.
  5. Transparent-strip door curtains.
- Warranty Period for Hydraulic System: One year from date of Substantial Completion.
- Trench drain oil separators and dry pipe suppression systems will be coordinated with mechanical design.

111823 VALUABLE MATERIAL STORAGE

- 'Knox-Box Rapid Entry System' to be used for key lock boxes.
- Boxes shall be installed near the front of the building for Fire Department access.

115213 PROJECTION SCREENS

- Provide front-projection screens manufactured from mildew- and flame-resistant fabric of type indicated for each type of screen specified and complying with the following requirements:
    1. Matte-white viewing surface are preferred.
    2. Glass-beaded viewing surface are not allowed.
- Coordinate locations of screen with reflected ceiling plan and emergency lighting.

118226 WASTE COMPACTORS AND DESTRUCTORS

- Size units for building size and bi-weekly pick-up.
- Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of Installer.
    1. Schedule regular surveillance and preventive maintenance visits at seven-day intervals for three months and at one-month intervals for nine months.
    2. Repair or replace worn or defective components; and lubricate, clean, and adjust equipment as required for proper equipment operation. Use replacement parts and maintenance supplies that were used in the manufacture and installation of the original equipment.
- Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Accurate Industries.
    2. Bes-Pac, Inc.
    3. Chicago Trashpacker Corp.
    4. Galbreath, Inc.
    5. GPI/Harmony Enterprises, Inc.
    6. Holt Specialty Equipment, Inc.
    7. J. V. Manufacturing, Inc.
    8. Kohlman Engineering Corp.
    9. K-Pac Equipment Division/Krause Corp.
    10. Marathon Equipment Co.
    11. McClain Group/E-Z Pack.
    12. Precision Machinery Systems, Inc.
    13. SP Industries, Inc.
- Vertical, Stationary Horizontal, Self-Contained Horizontal, Pivoting-Ram Compactors: Manufacturer's standard packaged units with components, options, and accessories needed to comply with requirements and provide complete functional systems.
- Train Owner's maintenance personnel to use and maintain waste compactors. Demonstrate capacities, safety features, cleaning procedures, and proper methods for storing and handling raw and processed waste materials.

BUILDING STANDARDS

DIVISION 12 -- FURNISHINGS

122113 HORIZONTAL LOUVER BLINDS

- This Standards Section should include University preferences on types of venetian blinds and accessories.
- Micro-blinds, mini-blinds, midi-blinds, macro-blinds with aluminum louver slats.
    1. Motorized blind operators.
- Definitions:
    1. Macro-blind: Venetian blind with nominal 2-inch wide or wider louver slat.
    2. Micro-blind: Venetian blind with nominal 1/2- to 5/8-inch wide louver slat.
    3. Midi-blind: Venetian blind with nominal 1-3/8-inch wide louver slat.
    4. Mini-blind: Venetian blind with nominal 1-inch wide louver slat.
- Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    1. Horizontal Louver Blinds: Before installation begins, for each size, color, texture, pattern, and gloss indicated, full-size units equal to 5 percent of amount installed.
- Subject to compliance with requirements, provide products by one of the following preferred manufacturers:
    1. Horizontal Louver Blinds, Aluminum Louver Slats:
        a. Comfortex Window Fashions.
        b. Hunter Douglas Window Fashions.
        c. Levolor Contract; a Newell Company; Levolor.
        d. Springs Window Fashions Division, Inc.; Bali.
        e. Springs Window Fashions Division, Inc.; Graber.
        f. Verosol USA, Inc.
    2. Horizontal Louver Blinds, PVC Louver Slats:
        a. Springs Window Fashions Division, Inc.; Graber.
    3. Horizontal Louver Blinds, Wood Louver Slats:
        a. Hunter Douglas Window Fashions.
        b. Levolor Contract; a Newell Company; Levolor.
        c. Mark Window Products.
        d. Springs Window Fashions Division, Inc.; Bali.
        e. Springs Window Fashions Division, Inc.; Nanik.
    4. Motorized Blind Operators: Only to be used where manual access is prohibitive and only with written approval from the University.
        a. Am-Source International.
        b. BTX Window Automation, Inc.
        c. Silent Gliss USA, Inc.
        d. SM Automatic.

122116 VERTICAL LOUVER BLINDS

- This Standards Section should include University preferences on types of vertical blinds and accessories.
    1. With aluminum vanes.
    2. With PVC vanes.
    3. With PVC vanes with fabric vane insert.
    4. With fabric vanes.
    5. Motorized blind operators.
- Vertical Louver Blinds: Before installation begins, for each size, color, texture, pattern, and gloss indicated, full-size units equal to 5 percent of amount installed.
- Subject to compliance with requirements, provide products by one of the following preferred manufacturers:
    1. Vertical Louver Blinds, Aluminum Vanes:
        a. Hunter Douglas Window Fashions.
        b. Levolor Contract; a Newell Company; LouverDrape.
        c. Springs Window Fashions Division, Inc.; Graber.
    2. Vertical Louver Blinds, PVC Vanes:
        a. Hunter Douglas Window Fashions.
        b. Levolor Contract; a Newell Company; LouverDrape.
        c. Springs Window Fashions Division, Inc.; Graber.
    3. Vertical Louver Blinds, PVC Vanes with Fabric Vane Insert:
        a. Hunter Douglas Window Fashions.
        b. Levolor Contract; a Newell Company; LouverDrape.
        c. Springs Window Fashions Division, Inc.; Graber.
    4. Vertical Louver Blinds, Fabric Vanes:
        a. Hunter Douglas Window Fashions.
        b. Levolor Contract; a Newell Company; LouverDrape.
        c. Solar Shading Systems.
        d. Springs Window Fashions Division, Inc.; Graber.
        e. VIMCO.
    5. Motorized Blind Operators: Only to be used where manual access is prohibitive and only with written approval from the University.

a. Am-Source International.
b. BTX Window Automation, Inc.
c. Silent Gliss USA, Inc.
d. SM Automatic.
e. VIMCO.

122413 ROLLER WINDOW SHADES

- Motorized shade operators are only to be used where manual access is prohibitive and only with the written approval of the University.

129300 SITE FURNISHINGS

- See UIC Project Manager for detailed University Standards.
- Refer to the University's Campus Exterior Signage Program manual for additional requirements.

BUILDING STANDARDS

DIVISION 13 -- SPECIAL CONSTRUCTION

- There are no unique University Standards for this section.

BUILDING STANDARDS

DIVISION 14 -- CONVEYING EQUIPMENT

141000 DUMBWAITERS

- Refer to applicable codes for rated construction requirements.
- Matot is the preferred manufacturer.

142100 ELECTRIC TRACTION ELEVATORS

- Scope
  1. General: These standards are intended to cover the installation of (number of elevators) passenger elevators in a first-class manner.
  2. Work: The work shall include, but not be limited to, complete control systems, controller assemblies, machine assemblies, door operation systems, door protection systems, car assemblies and signal systems on Elevators # (elevator numbers).
  3. Location: The work shall be performed at the University of Illinois at Chicago, Building (building number), (building legal address), Chicago, Illinois.
- Work Included:
  1. General: Contractor shall include all work necessary to complete the elevator installation per the Contract Documents.
  2. Code Compliance: Contractor shall provide any additional material or modifications to equipment required to meet applicable Codes, Standards and Laws.
  3. First-class Condition: Contractor shall include servicing, lubrication and painting of equipment to insure all equipment is in first-class condition at the completion of the project.
  4. Multiple Parts: Contractor shall provide the proper number of devices or parts required. In all cases where a device or a part of the equipment is herein referred to in the singular, it is intended to apply to the number of devices or parts required to complete the installation.
- Work Not Included:
  1. General: Contractor shall coordinate the work identified with the other contractors.
  2. Machine Room Requirements:
     a. Enclosure: Fire-rated walls shall be provided to isolate elevator equipment from other equipment.
     b. Access: Fire-rated door shall be provided which is self-closing and self-locking. Permanent noncombustible stairs with handrails shall be provided where floor levels for access are different.
     c. Cooling: Air conditioning shall be provided to prevent room from exceeding the maximum equipment operating temperature requirements.
     d. Heating: Heater shall be provided to prevent room from falling below the minimum equipment operating temperature requirements.
     e. Painting: Walls in machine rooms shall be painted.
     f. Fire Extinguisher: An ABC fire extinguisher shall be provided in each machine room area.
  3. Hoist-way Requirements:
     a. Enclosure: Fire-rated wall shall be provided. Front wall shall be constructed after entrance frames have been installed.
     b. Alignment: Hoist-way shall be provided which is plumb within 1 inch.
     c. Projections: Beveled guards shall be provided where the side or rear wall projects, recedes or is set back more than 2 inches.
     d. Cutting: Walls shall be cut for fixtures.
     e. Patching: Walls shall be patched for fixtures. Walls shall be patched for drywall-type entrance assemblies.
     f. Grouting: Walls shall be grouted for concrete-type entrance assemblies. Floors shall be grouted for sills.
     g. Painting: Walls around entrances and fixtures shall be painted.
     h. Venting: Venting shall be provided to prevent accumulation of smoke and gases as required.
     i. Pit Access: Ladders shall be provided in pits.
  4. Electrical Requirements:
     a. Mainline Disconnects: One lockable, fused three-phase mainline disconnect shall be provided for each elevator in the machine room.
     b. Cab Lighting Disconnect: One fused single-phase service with switch shall be provided for each elevator in the machine room.
     c. Machine Room Lighting: Adequate lighting (minimum 10 ftc) shall be provided in the machine room. One light switch shall be provided on the lock-jamb side adjacent to each machine room access door. Two duplex outlets shall be provided in the machine room.
     d. Pit Lighting: Adequate lighting (minimum 5 ftc) shall be provided in the pit area. At least one covered light fixture shall be provided for each elevator. One light switch accessible from the pit entry for each elevator and duplex outlet shall be provided in each pit area.

e. Standby Power: Adequate power to operate one elevator in each group shall be provided from the standby generator. Means for absorbing regenerate power shall be provided.
f. Standby Power Signals: Two signals shall be provided to each elevator operational control system. One signal shall activate when the power has transferred to the standby power source. The other signal shall activate prior to transfer back to normal power. This pre-transfer signal shall be adjustable and initially set at 30 seconds.
g. Conduit: Conduit shall be provided from elevator hoist-ways to Fire Control Panel.

5. Cab Requirements:
   a. Flooring: Tile shall be provided for each elevator cab.
6. Communication Requirements:
   a. Telephone Service: Specify the electrical contractor to provide ¾ inch conduit, from the nearest telephone closet (FDF), 4 pair CAT 5 telephone cable and a "D-MARK" junction box near the controller of each elevator for the purpose of providing ADA compliant telephone service in each cab. Final trimming, testing and programming shall be performed by University Telecommunication Department.
   b. Emergency Telephone Device: Standard University Emergency Telephone Unit (ETU), hands free, ADA compliant, will be provided by the University. Elevator contractor shall make necessary cut out, and provide mounting flanges with 4 tapped holes, so that the unit could be secured flush to either the front return/entrance swing column unless shown otherwise on drawings. The University will loan a prototype of the ETU to the elevator manufacturer contractor for making proper cut outs and mounting reinforcement mechanism.

- Quality Assurance:
  1. Qualified Bidders: Contractor shall submit the following certified information with the bid:
     a. Contractor is currently engaged in the manufacturing and installation of elevator equipment and has been for the previous twenty-five (25) years.
     b. Contractor shall have technical qualifications of at least ten (10) years installing microprocessor-based elevator equipment. Qualification shall be based on having trained supervisory and installation personnel and the facilities to install the elevator equipment proposed in the Chicago area.
     c. Contractor shall submit a list of installations totaling 100 elevators where all the elevator equipment proposed for this installation has been completed.
     d. Contractor shall submit a list of five or more local (in the Chicago area) installations where all the elevator equipment proposed for this installation has been completed by him.
  2. Approved Manufacturers: Contractor shall provide material from specified manufacturers.
  3. Other Manufacturers: Contractors may not provide material from other manufacturers.
- Code Compliance:
  1. General: Contractor shall comply with most-stringent applicable provisions of the following Codes, Standards and Laws including revisions and changes in effect on date of these standards.
  2. Elevator:
     a. ASME A17.1 - Safety Code for Elevators and Escalators.
     b. ASME A17.2 - Inspectors' Manual.
     c. ASME A17.3 - Safety Code for Existing Elevators and Escalators.
  3. Electrical
     a. NFPA 70 - National Electrical Code.
  4. Building:
     a. City of Chicago Building Code
  5. Life Safety:
     a. NFPA 101 - Life Safety Code
     b. City of Chicago fire authority.
  6. Handicapped Accessibility:
     a. Americans with Disability Act.
     b. Illinois Environmental Barriers Act.
     c. ANSI A-117.1
        i. Specifications for Making Building and Facilities
        ii. Accessible to, and Usable by, the Physically
        iii. Handicapped.
  7. Laws: Any other Ordinances and Laws applicable within the governing jurisdiction.
- Schedule:
  1. General: The contractor shall submit a complete schedule, including material delivery dates, within 14 days of Award of Contract.
  2. Award of Contract: Contractor shall not proceed until the contract is signed by the Owner. Owner may provide written notification to proceed prior to signing contract. Date of notification shall serve as the date of Award of Contract for

scheduling purposes.
3. Installation Period: The contractor shall not begin the installation until all material for the first elevator is delivered.
4. Final Acceptance: Contractor shall continue to work at the location until the final acceptance of the last elevator is completed.

- Pre-Installation Submittal:
  1. General: Contractor shall assemble complete submittal packages within 30 days of Award of Contractor.
  2. Product Data: Contractor shall submit six (6) copies of the manufacturer's specifications and installation instructions for each product furnished.
  3. Power Data: Contractor shall provide electrical calculations for all three-phase and single-phase feeder requirements.
  4. Test Data: Contractor shall provide certified laboratory test reports on components as specified or required by referenced codes.
  5. Keying: Contractor shall coordinate all keying with the Owner. Key switches shall be Best unless otherwise specified, and shall have construction cores. University at the end of Warranty period will re-key the switches.
  6. Material Samples: Contractor shall provide three (3) samples for each material furnished.
  7. Initial Shop Drawings: Contractor shall submit one (1) mylar and six (6) copies of the layout, cab and fixture drawings for review.
  8. Drawing Review: Drawing review shall not be interpreted as an indication that submittal is correct or that work represented by submittal complies with the Contract Documents.
  9. Submittal Response: One mylar and two copies shall be returned to the Contractor within 14 days. Submittal response is not justification for revision of delivery or installation schedules without prior written notification.
  10. Revised Shop Drawings: Contractor shall incorporate changes and return one copy within 7 days.
- Permits, Inspections and Reviews:
  1. General: Contractor shall coordinate all inspections and reviews.
  2. Permits: Contractor shall obtain and pay for permits, licenses and inspection fees necessary to complete the elevator installation.
  3. Inspections. Contractors shall make all tests required by the referenced codes and/or inspection authorities. Contractor shall notify inspection authorities with sufficient notice and have inspection performed prior to reviews. Inspection delays are not justification for revision of installation schedules without prior written notice.
  4. Reviews. Contractor shall provide the personnel for acceptance reviews and final reviews indicated in the Contract Documents. Contractor shall provide 7 days notice to the Owner for each review.
- Post-Installation Submittal:
  1. General: Contractor shall assemble complete submittal package within 30 days of final acceptance of the final elevator.
  2. Final Shop Drawings: Contractor shall provide six (6) complete sets of "AS INSTALLED" drawings. All changes shall be revised on the manufacturer's drawings. No hand written changes will be accepted.
  3. Electrical Wiring Diagrams: Contractor shall provide six (6) complete sets of "AS INSTALLED" electrical wiring diagrams (EWD's). All changes shall be revised on the manufacturer's drawings. No hand written changes will be accepted.
  4. Maintenance Manuals: Contractor shall provide six (6) copies of neatly bound manuals including instructions explaining all operating features, parts lists, recommended spare parts, lubrication charts and recommended maintenance schedule. Contractor shall also provide three (3) separate copies of the adjustment, system overview, service tool and troubleshooting manuals.
  5. Keys: Contractor shall provide the control key of construction cores and three (3) sets of properly tagged keys to operate all key switches and locks upon completion of the first elevator.
  6. Service Tool: Elevator Contractor shall furnish to the University two (2) laptop PC service tool with necessary software needed for adjusting, trouble shooting and performing safety and operational tests. It must be emphasized that the service tool shall be used exclusively by University elevator mechanics and it shall be used only for the elevator(s) provided under the scope of this project. The service tool shall be delivered to the University elevator foreman on or before the training session described by item 12 of these standards. All necessary updating of this tool will be performed at no cost to the University.
- Warranty:
  1. Period: Contractor shall guarantee that the materials and workmanship of the elevator equipment installed under these standards shall be first-class in every respect. Contractor shall make good all defects, not due to ordinary wear and tear or improper use, which may develop within one year after the final acceptance.
  2. Periodic Examination: During the Warranty period the contractor shall lubricate all parts, examine all components of the elevators for conformance with specified design features such as, the door timings, checking and replacing burnt out bulbs of signals, group operation, speed of elevator, etc. The periodic examination will be conducted at least for one (1) hour every

month for each elevator. Prior to performing the examination the contractor shall notify the UIC elevator foreman at least 2 days advance of the scheduled examination date. Failure to provide this examination will result in proportionate extension of warranty period.

3. Service: Contractor shall provide call back warranty service at no cost to the University, with a response time not to exceed 2 hours, as follows:
    a. Maintenance work, including 24 hour-per-day, 7 day-per-week emergency call back repair service, shall be performed by trained employees of the elevator contractor.
    b. Contractor will maintain an accurate log of all service calls, including details of the malfunctions and repairs performed.
    c. At the end of the warranty period the service call log will be turned over to the University Elevator Foreman.
4. End of Warranty Period Review: Contractor shall provide personnel for one warranty review. Owner may schedule this review anytime during the warranty period, contractor shall provide any modifications to the elevator equipment and any adjustment necessary to meet requirements of the Contract Documents identified during the warranty review within 30 days of notification.

- Training:
    1. General: Elevator Contractor shall provide training to representatives of the Owner as follows:
        a. On-Site: Contractor shall provide two (2) 40-hour, uninterrupted adjuster level training sessions to University elevator mechanics on University premise. University Facilities Management will make necessary on-campus/on-site arrangement for this training. Training shall include detailed overview of operational control system, motion control system, door control system, signal system, trouble shooting, servicing and periodic maintenance required.

- General:
    1. Outline:
        a. Quantity: (calculated number of elevators) Passenger Elevators
        b. Type: Geared Overhead Traction
        c. Capacity: (calculated capacity) Pounds
        d. Speed: (calculated speed) FPM
        e. Stops: (number of stops)
        f. Openings: (number of openings)
        g. Floors Served: (nomenclature of floors)
        h. Travel: (travel of elevators) Feet
        i. Entrance Size: 3'6" Wide by 7'0" High
        j. Entrance Type: Center Opening
    2. Pre-Engineered Systems: The elevators provided shall be from the following pre-engineered product lines:
        a. ThyssenKrupp Elevator - TAC 50 VVVF
        b. KONE Inc. - Miprom 21 VVVF
        c. Otis - Elevonic 411
    3. Design Parameters: The elevator system shall be designed, installed and adjusted to meet the following requirements:
        a. Flight Time: The elevators shall arrive at the next typical floor with the doors open two-thirds within (calculated flight time) seconds from the start of door closing movement. This shall be accomplished regardless of load on the elevator or direction of the elevator.
        b. Door Motion Times: The elevators shall open its doors within (calculated door open motion time) seconds. The elevators shall close its doors within (calculated door close motion times) seconds or the minimum allowed by Code, whichever is greater. Door times are measured from the start of movement until movement is stopped.
        c. Floor Accuracy: The elevators shall stop within ¼" of floor regardless of load or direction and re-level to within ¼" during loading/unloading.
        d. Speed: The elevators shall operate within 3% of the contract speed regardless of load or direction.
        e. Ride: The elevators shall operate smoothly, with less than 15 mg horizontal acceleration, less than 4.0 feet per second-squared vertical acceleration and less than 8.0 feet per second-cubed vertical jerk.
        f. Noise: The elevators shall operate quietly, with less than 55 dBa within the cab with the doors closed, 60 dBa with door operation and 65 dBa within the machine room. Noise is measured with a Dranatz Sound Meter on the C scale with the background noise less than 45 dBa.
        g. Noise: The elevators shall operate quietly, with less than 55 dBa within the cab with the doors closed, 60 dBa with door operation and 65 dBa within the machine room. Noise is measured with a Dranatz Sound Meter on the C scale with the background noise less than 45 dBa.
            i. Mainline Feeders: The elevator shall have a starting current of less than (calculated starting current) amps and a running current of less than (calculated running current) amps with the three-phase incoming voltage maintained within +/- 10% of 480 Volts AC and with +/- 3% of 60 cycles.
            ii. Mainline Harmonics: The elevator shall add not more than 5%

harmonic distortion and shall meet the requirements of IEEE 519.

iii. Lighting Feeders: The elevator shall have a lighting and fan current of less than 20 amps with the single-phase voltage being maintained within +/- 10 of 120 Volts AC.

h. Environment:
   i. Temperature: The elevator shall be capable of operating properly with the temperature being maintained below 90 degrees Fahrenheit in all equipment areas.
   ii. Humidity: The elevator shall be capable of operating properly with the humidity being maintained below 90% non-condensing in all equipment areas.

i. Heat Emissions:
   i. Machine Room: The elevator shall not produce more than (calculated equipment heat emissions) BTU's in this area.
   ii. Hoist-way: The elevator shall not produce more than (calculated equipment heat emissions) BTU's in this area.

- Control Systems:

1. Operational Control:

a. Group Orientation: Provide group operational control to operate all the elevators in each group automatically in response to car and hall calls. The elevators shall be assigned calls as they are registered. The closest elevator shall be assigned a hall call based on the estimated time of arrival (ETA). Penalties shall be given to long established hall calls and bonuses for coincident calls. The elevator shall stop for hall calls only in the direction of travel. The elevator shall reverse automatically in response to a hall call in the opposite direction of travel. The elevator shall reverse without door cycle after hold open time has expired when there is no further demand in the direction of travel and shall close after the additional hold open time has expired. The elevators shall zone after the last call is answered. There shall be one zone for each elevator in the group. The lobby zone shall be the first zone filled.

b. Firefighter's Service Operation: Provide means to operate the elevators during an emergency. Also provide connections for future smoke detector activation of lobby and alternate floor automatic return.

c. Inspection Operation: Provide means to operate the elevator at reduced speed from the top of the elevator. Activation of Inspection Operation shall remove the elevator from service.

d. Independent Service Operation: Provide means to operate the elevator in response to only car calls. Close doors by holding a car call until doors are completely closed. Activation of Independent Service Operation shall remove the elevator from service. The elevator shall park with the doors open at the last floor served.

e. Hoist-way Access Operation: Provide means to operate elevator at the top and bottom terminals at reduced speed with both the hoist-way doors and the car doors open. Terminal access shall be zoned.

f. Car-To-Terminal Operation: Provide means to initiate a demand at the terminal when the access key switch is activated. The elevator shall arrive at the terminal without activating the hall lantern or canceling the hall call. The elevator shall remain at the terminal for 15 to 30 seconds to allow the elevator to be placed on inspection operation. In the event that the elevator not be removed from service during the allotted time, the elevator shall return to group operation.

g. Load By-pass Operation: Provide means to by-pass hall calls in the event that the elevator is sufficiently loaded. Initial setting of the load sensing device shall be 50% of the capacity of the elevator.

h. Load Demand Operation: Provide means to initiate a hall call demand when an elevator becomes sufficiently loaded when responding to a hall call. The hall call demand shall be initiated in the direction in which the elevator was traveling and shall be initiated upon activation of the load sensing device (while the doors are open). Initial setting of the load sensing device shall be 40% of the capacity.

i. Delayed Operation: Provide means to remove an elevator from group operation in the event that it is delayed and cannot respond to demands.

j. Anti-Nuisance Operation: Provide means to cancel car calls in the event that the elevator makes three (3) consecutive stops without interruption of the door screen.

k. Programmed Shutdown Operation: Provide means to stop the elevator at the next floor, open the doors and remove the elevator from service. The controller shall prevent the operation of the elevator until the problem is manually reset. This operation shall activate by the governor over-speed device, machine room over-temperature monitor and reduced incoming power monitor.

l. Hall Button Failure Operation: Provide means to maintain the registration of hall calls in the event all the elevators are removed from service for less than 5 minutes except for firefighter's service feature. After 5 minutes, all hall calls shall be canceled and remain canceled. The timer shall be reset every time one elevator is back in-service.

m. Standby Power Operation: Provide means to automatically return one elevator at a time to the main floor. After the last elevator has returned to the main floor, one elevator shall continue to operate. Provide means to override automatic return and manually select any elevator in the group.
n. Advance Lantern Operation: Provide means to indicate direction of elevator travel. Lantern shall light at between 6 to 8 seconds prior to door open movement and shall stay lit until doors begin to close. Audible signal shall sound when the lantern is lit and shall sound once for up travel and twice for down travel.
o. Back-up Group Operation: Provide means to maintain elevator service in the event that the group operation control system cannot assign hall call demands.

2. Motion Control:
   a. Automatic Operation: Provide motion control which automatically decelerates, levels and stops the elevator in response to a call.
   b. Re-Leveling Operation: Provide means to level the elevator after the elevator has stopped to maintain floor accuracy.
   c. Reduce Power Operation: Provide a means of monitoring incoming voltage. When improper power is detected, each elevator shall first attempt a programmed shutdown operation. When improper power to safely operate the elevator is detected, the elevator shall stop immediately. The monitor shall prevent the operation of the elevator if proper power is not available.
   d. Over-Travel Limiting Operation: Provide means to prevent the operation of the elevator when it travels beyond the leveling zone at a terminal floors. The limits switches shall operate quietly.
3. Door Control
   a. Automatic Operation: Provide door control which automatically opens and closes doors.
   b. Force Limiting Operation: Provide means to limit the door pressure while closing to a maximum of 30 pounds (measured from rest) and a maximum of 7.5 foot-pounds kinetic energy.
   c. Reduced Stall Force Operation: Provide means to reduce the force exerted on the doors during a stall condition. Door pressure shall be zero pounds after one second.
   d. Reduce Speed Closing Operation: Provide means to reduce the speed during closing to a maximum of 2.5 foot-pounds kinetic energy. Doors shall close at reduce speed during Firefighter's Service as required.
   e. Nudging Operation: Provide means to sound audible electronic tone when doors are held open for longer than the setting of the Nudging Timer. Doors shall remain fully open if door screen continues to be obstructed. Doors shall fully reopen if door screen becomes obstructed during closing.
   f. Door Hold Operation: Provide separately adjustable timers to vary the time the doors hold open as follows:
      i. Car Call Timer: The amount of time the doors shall be held in response to a car call. Timer setting shall be between 3.0 and 6.0 seconds.
      ii. Hall Call Timer: The amount of time the doors shall be held open in response to a hall call or coincident call. Timer setting shall be between 4.0 and 8.0 seconds.
      iii. Interrupted Screen Timer: The amount of time the doors shall be held open after the screen is reestablished. Timer setting shall be between 1.0 and 3.0 seconds. Timer shall be reset with each interruption of the door screen.
      iv. Door Reversal Timer: The amount of time the door shall be held open after doors are fully reopened. Timer setting shall be between 1.0 and 3.0 seconds.
      v. Nudging Timer: The amount of time the doors shall be held open before sounding an audible tone. Timer setting shall be between 20 and 30 seconds.
      vi. Initial Timer Settings: Timers shall be initially set to the minimum allowed by handicapped accessibility standards within the range. Car call and door close buttons shall have no effect on timers.
   g. Door Stall Operation: Provide means to reopen doors in the event that the doors do not close all the way within 30 seconds of closing operation. Provide means to remove the elevator from service after the third unsuccessful attempt.

- Controller Assemblies:
  1. General: Provide material from ThyssenKrupp Elevator, KONE Inc., or Otis.
  2. Microprocessor: Provide a microprocessor-base unit for operational and communication function. Provide ThyssenKrupp - TAC 50 - VVVF model, KONE Inc. Miprom 21 VVVF model, or Otis Elvonic 411 model.
  3. Software: Provide nonproprietary type.
  4. Service Tool: Provide all service tools require for troubleshooting.
  5. Drive: Provide solid-state VVVF control for A.C. hoist motor.
  6. Position Sensing: Provide digital solid-state type with maximum ¼" per pulse.

Provide a system that does not utilize a stationary tape in the hoist-way A LED-type position indicator shall be located in the machine room.

7. Contactors and Relays: Provide solid-state contactor which shall be sized to insure proper conductivity and reliable operation. Contactor shall be Nordic or equal.
8. Identifications: Provide permanent markings for all components, including size and type of fuses, identical to those symbols found on the Electrical Wiring Diagrams.
9. Isolation Transformers/Filters: Provide transformers and filters to isolate noise from the electrical system.
10. Labeling: Provide UL, CSA or ASME A.17.5 label.

- Machine Assemblies:
  1. General: Provide material from ThyssenKrupp Elevator, KONE Inc. or Otis.
  2. Machine: Provide worm-geared traction type with deflector sheave mounted on an isolated bed-plate.
  3. Motor: Provide A.C. type directly mounted to the machine.
  4. Brake: Provide D.C. type with switch to monitor brake operation.
  5. Vibration Sound Dampeners: Provide rubber type to isolate the machine from the building structure.
- Door Operation Systems:
  1. General: Provide material from ThyssenKrupp Elevator, KONE Inc. or Otis.
  2. Operator: Provide high-speed, heavy-duty DC master type operator with digital velocity and position feedback. Provide a contact on the car door which shall prevent the operation of the elevator when the car door is not closed.
  3. Header: Provide steel type shaped to provide stiff flanges.
  4. Tracks: Provide removable bar or formed steel with contours to match the hangers. Each track shall be reversible.
  5. Hangers: Provide polyurethane-type with pre-lubricated sealed bearings which will allow vertical and lateral adjustment of the hoist-way and car door panels. Each door panel shall have two-point suspension with separate replaceable hangers. Upthrust shall be provided to maintain alignment of the door panels.
  6. Gibs: Provide two nylon-type per door panel. Fire stops shall be properly bent down on hoist-way door panels.
  7. Interlocks: Provide an electromechanical device which shall prevent the operation of the elevator when the hoist-way doors are not closed and locked.
  8. Restrictor: Provide device which restricts the opening of the car doors outside the unlocking zone.
  9. Closer: Provide spirator or sash weight type which shall close the hoist-way doors from any open position.
- Door Protection Systems:
  1. General: Provide material from Janus Elevator Products, Inc.
  2. Door Screen: Provide infrared pulsed type which shall initiate door reopening operation. Provide Panaforty model.
  3. Controller: Provide two-relay type which shall allow reduced speed door closing operation. Provide Panacombi Mark II model.
  4. Labeling: Provide UL or CSA label.
- Car Assemblies, Guide and Balance Systems:
  1. General: Provide material from ThyssenKrupp Elevator, KONE Inc. or Otis.
  2. Car Frames: Provide steel plank, crosshead and stiles. Provide new Car Top Inspection Stations with properly covered work light and 3-wire grounded-type outlet permanently mounted to the crosshead of each elevator. Provide new Crosshead Data Tags permanently mounted to the crosshead adjacent to the original data tags. Both the stations and the data tags shall be easily accessed from the hoist-way landing.
  3. Platforms: Provide steel type isolated from the car frame.
  4. Car Guide Rails: Provide standard T-type steel rails with brackets for attachment to building structure. Provide any backing or intermediate tie brackets.
  5. Car Guide Assemblies: Provide roller-type which allows front-to-back and side-to-side adjustments of each guide. Each arm shall be spring mounted with adjustable stops. Rollers shall operate at less than 250 rpm. Guide assemblies shall be designed maintain guidance with the loss of the roller.
  6. Car Balance: Provide mounting locations and additional weight for balance of the elevator.
  7. Counterweight Guide Rails: Provide standard T-type steel rails with brackets for attachment to building structure. Provide any backing or intermediate tie brackets.
  8. Counterweight Guide Assemblies: Provide roller-type which allows front-to-back and side-to-side adjustment. Each arm shall be spring mounted with adjustable stops. Rollers shall operate at less than 500 rpm. Guide assemblies shall be designed maintain guidance with the loss of rollers.
  9. Counterweight Frame: Provide steel frame with rods for counterweights. Provide sufficient means to hold counterweights and provide quiet operation.
  10. Counterweights: Provide sufficient number and type of weights as required for the motion control system. Weights shall be designed for the counterweight frame and have holes for the rods. Rods shall be secured by cotter pins through the locknuts.
  11. Counterweight Guards: Provide steel guard for counterweight area in pit.

- Safety and Buffer Systems:
    1. General: Provide material from ThyssenKrupp Elevator, Hollister-Whitney Elevator Corp., KONE Inc. or Otis.
    2. Governors: Provide centrifugal-type with bi-direction switches. Provide new test data tags.
    3. Safeties: Provide flexible guide clamp type. Provide new test data tags.
    4. Governor Tension Sheaves: Provide standard sheave with bracket mounted to the guide rails. Provide pivots for free movement and proper tension.
    5. Car Buffers: Provide oil type mounted in the pit with protective covers. Provide switch to prevent operation of the elevator should the buffer not be fully extended. Provide new test data tags.
    6. Counterweight Buffers: Provide oil type mounted in the pit with protective covers. Provide switch to prevent operation of the elevator should the buffer not be fully extended. Provide new test data tags.
- Rope Systems:
    1. General: Provide material from Bethlehem Wire Rope/Williamsport Wirerope Works, Inc. or Macwhyte Company
    2. Hoist: Provide a minimum of four ropes with a minimum diameter of ½". Provide data tag.
    3. Governor: Provide one rope with a minimum diameter 3/8". Provide data tags.
    4. Shackles: Provide wedge-type babbittless type at both ends.

- Hoist-way Entrance Assemblies:
    1. General: Provide material from Dover Elevator Company, Hauenstein & Burmeister, Montgomery Elevator Company or Schindler Elevator Company.
    2. Entrance Frames: Provide #4 brushed stainless steel bolted type. Provide UL label on hoist-way side of entrance frame and transom.
    3. Door Panels: Provide #4 stainless steel sandwich type without binder angles. Provide matching or integral sight guards. Provide door panels with rubber astragal to cushion impact. Provide UL label on hoist-way side of door panel. Provide 4" high floor marking on hoist-way side of one door panel.
    4. Sills: Provide extruded aluminum with grooved surface. Provide support angles which require minimal grouting.
    5. Entrance Markings: Provide plates on both sides of the hoist-way entrance centered 60" above the finished floor bolted from the back of the plate through the entrance frame. All floors shall be identified by 2" high raised numbers/letters/symbols and Braille.
    6. Escutcheons: Provide hole in hoist-way door panel to allow special tool for releasing interlock for each elevator at each floor.
    7. Fascia: Provide standard fascia.
- Cab Assemblies:
    1. General: Provide material from Dover Elevator Company, Eklund, Hauenstein & Burmeister, G&R, Globe Architectural, Montgomery Elevator Company or Schindler Elevator Company.
    2. Shell: Provide reinforced 14-gage steel with black baked enamel finish. Apply sound deadening to exterior.
    3. Canopy: Provide reinforced 12-gage steel with white baked enamel finish.
    4. Suspended Ceiling: Provide six (6) translucent panels in an aluminum frame and size to match reveals between wall panels.
    5. Side and Rear Walls: Provide plastic laminated removable panels. Provide three panels on side walls and two panels on rear wall.
    6. Transom: Provide #4 brushed 14-gage stainless steel.
    7. Front Return/Entrance Columns: Provide #4 brushed 14-gage stainless steel. Entrance columns shall be separate. Entire front return shall swing on concealed hinges. Provide engraving for No Smoking, Capacity, Elevator Number and Emergency Communication. Engrave Firefighter's Service Operation instructions as required.
    8. Door Panels: Provide #4 brushed stainless steel sandwich-type without binder angles.
    9. Sill: Provide extruded silver nickel with grooved surface. Provide support angles which require minimal grouting.
    10. Handrails: Provide one line of #4 brushed 2" by 3/8" stainless steel bars on all three sides with returned ends. Mounting shall be through the car walls from the back and top of handrails shall be 32" above finished door.
    11. Emergency Lighting: Provide battery unit with solid-state charger to operate its alarm bell and a minimum of two cab lights. Lights shall be part of normal lighting system and shall properly illuminate main car station.
    12. Emergency Exit: Provide hinged hatch for evacuation of the elevator through the top of the elevator. Provide contact to prevent operation of the elevator when the hatch is not closed.
    13. Ventilation: Provide Morrison "PE" multi-speed exhaust blower for proper air flow through elevator cab.
- Signal Systems:
    1. General: Provide material from Adams Elevator Equipment Company, ThyssenKrupp Elevator, KONE Inc. or Otis.
    2. Main Car Station
        a. Car Position Indicator: Provide 1" high digital segmented type with

direction indicators representing the floor served and the direction of travel. Provide MH-110 model.
    b. b. Pushbuttons: Provide 1-1/8" flush pushbuttons with white LED illumination. Provide standard pushbuttons for each floor served which illuminate to indicate call has been registered. Provide emergency control pushbuttons for alarm, door open, door close, telephone and floor passing signal.
    c. Pushbutton Markings: All pushbuttons shall be identified by raised numbers/letters/symbols and Braille. Floor pushbuttons and floor passing signal pushbutton shall have a 5/8" high designation in the face of each button. All other pushbuttons shall have 1/8" high designations in the face of each button for identification.
    d. Firefighter's Service Controls: Provide keyed switch, light jewel, audible solid-state signal and call cancel pushbutton.
    e. Emergency Communication: Mount vandal-resistant telephone unit provided by Owner in car station. Phone shall be programmed to signal Security Department. Phone shall be capable of operating with the remote monitoring system.
    f. Floor Passing Signal: Provide adjustable audible electronic tone which sounds each time the elevator passes a floor. Pushbutton shall be identified by the letter "S" and shall activate passing tone for entire trip until elevator reverses direction.
    g. Location: Pushbuttons shall be located between 35" and 48" above the finished cab floor. Emergency control pushbuttons shall be grouped at the bottom. Firefighter's Service controls shall be grouped above the pushbuttons. Emergency communication device shall be behind a round grille with 1/16" holes above the firefighter's service controls.
  3. Service Cabinet:
    a. Access: Provide a flush, keyed #4 brushed stainless steel door with window for Certificate of Inspection. Window size shall be identical to local certificate size.
    b. Controls: Provide switches for Stop, Inspection, Independent Service, Lighting and Fan. Provide test button for Emergency Lighting.
    c. Location: Cabinet shall be located below the main car station.
  4. Hall Lanterns: Provide 2-1/2" high triangular type with #4 brushed stainless steel faceplates located adjacent to each hoist-way entrance. Provide adjustable audible electronic tone.
  5. Hall Stations: Provide one #4 brushed stainless steel stations per floor with 1-1/8" standard pushbuttons with white LED illumination. Hall Stations shall be typically flush mounted.
  6. Firefighter's Signs: Provide one #4 brushed stainless steel sign above each hall station with wording and symbol as contained in Appendix H.
  7. Hoist-way Access Stations: Provide switch with #4 brushed stainless steel faceplates at each terminal located adjacent to the hoist-way entrance.
  8. Firefighter's Service Station: Provide at the main firefighter's floor installed per local requirements. Engrave firefighter's service instructions as required in #4 brushed stainless steel faceplate.
  9. Fire Control Panel: Provide #4 brushed stainless steel faceplate recess mounted above the main floor hall station with the following:
    a. ½" high LED segmented position indicators with direction arrows for each elevator.
    b. Standby power manual override key switches with collars for each elevator.
    c. Power light for each elevator.
    d. Firefighter's telephone jack.
  10. Firefighter's Key Box: Provide surface mounted type with #4 brushed stainless steel door. Provide keys and mount per local requirements.
  11. Pit Emergency Stop Switch: Provide with red switch.
- Wiring:
  1. General: Provide material from Siecor/Republic Wire and Cable.
  2. Conductors: Provide new copper wiring throughout, including motor leads. There shall be no slices.
  3. Traveling Cables: Provide a minimum of two cables per elevator. The cables shall have a flame retardant and moisture resistant outer cover. Provide pads where necessary to prevent damage to the cables during operation of the elevator.
  4. Terminals: Provide permanent identification at all connections.
  5. Spares: Provide an additional 10% conductors for future use. Provide four additional twisted shielded pair conductors between the machine room and the main car station. Tag conductors as "SPARES".
- Initial Site Review
  1. General: Contractor shall thoroughly review all elevator areas before commencing work.
  2. Dimensions: Contractor shall verify proper space has been provided for elevator equipment in the machine room, hoist-way and pit areas. Contractor shall also verify that these areas are ready for the installation of the elevator equipment.
  3. Clearances: Contractor shall verify proper clearances for the elevator

equipment can be maintained within the space provided.
4. Electrical: Contractor shall verify proper electrical power has been provided. Temporary power of the same characteristics as the permanent power shall be used if available.
5. Environmental: Contractor shall verify proper operating environment has been provided.
6. Variations: Contractor shall provide written notification of any and all conditions which will prevent producing satisfactory work within the schedule.
7. Acceptance: Contractor shall accept conditions prior to commencement of work. Start of work shall be interpreted as acceptance of conditions.

- Transportation and Storage:
  1. General: Contractor shall properly protect equipment and architectural finishes during transportation and storage.
  2. Transportation: Contractor shall deliver and store materials in original protective packaging.
  3. Storage: Contractor shall store equipment in the machine room Any storage outside the machine room shall be coordinated with the Owner.
- Installation:
  1. General: Contractor shall perform all work in a first class work workmanship manner.
  2. Standards: Contractor shall install equipment per Manufacturer's standards and in accordance with referenced codes.
  3. Tolerances: Contractor shall install equipment per Manufacturer's standards and in accordance with referenced codes.
  4. Maintainability: Contractor shall install equipment so components may be easily accessed for removal during maintenance and repair.
  5. Field Welding: Contractor shall utilize certified welders. Oxidation and residue shall be chipped and cleaned away. All welds shall be wire brushed and painted with two coats of primer prior to finished coat.
  6. Unused Equipment: Contractor shall remove all unused equipment.
  7. Lubrication: Contractor shall lubricate all equipment.
  8. Wiring: Contractor shall wire equipment as indicated on the electrical wiring diagrams. Corresponding signals shall both illuminate when either button is registered.
  9. Coordination: Contractor shall coordinate all Work-Not-Included scheduled during the installation period.
  10. Protection: Contractor shall advise Owner of protection procedures to prevent damage or deterioration of work completed during the remainder of the installation period.
- Adjustments:
  1. General: Contractor shall properly adjust the components provided.
  2. Design Parameters: Contractor shall adjust the elevator to meet the design parameters.
  3. Guide Rails: Contractor shall realign car and counterweight guide rails vertically with tolerance of 1/16". All connections shall be checked and tightened. Joints shall be secured without gaps. Any irregularities on the machined surface shall be filled, sanded and filed to a smooth surface.
  4. Balance: Contractor shall balance elevators front-to-back and side-to-side to equalize pressure of roller car guide rollers on the car guide rails.
  5. Guide Assemblies: Contractor shall adjust car and counterweight guides to maintain roller contact with the guide rails regardless of load or position in hoist-way
- Testing:
  1. General: Contractor shall test the elevator in accordance with applicable codes.
  2. Brakes: Contractor shall test the brakes with maximum load.
  3. Governors: Contractor shall test the governors.
  4. Safeties: Contractor shall test the safeties with full load at full speed.
  5. Buffers: Contractor shall test the buffers with full load at maximum speed.
- Cleanup:
  1. General: Contractor shall keep work areas orderly and free from debris during the installation.
  2. Daily Removal: Contractor shall remove packaging and other materials on a daily basis as equipment is installed.
  3. Daily Cleaning: Contractor shall clean work areas on a daily basis of dirt, oil and grease.
  4. Final Cleaning: Contractor shall clean machine rooms, controllers, hoist-ways, pits, hoist-way equipment, hoist-way entrance assemblies, pit equipment, door operating equipment, cab enclosures and fixtures of dirt, oil, grease and finger marks prior to acceptance review.
- Painting and Finishes:
  1. General: Contractor shall provide painting and finishing of materials provided.
  2. Equipment: Contractor shall clean and paint all equipment which is provided with one coat of installer's standard enamel unless the equipment has a baked enamel or special architectural finish. Stencil paint 4" high elevator number on the mainline disconnect, car lighting disconnect, each control cabinet, crosshead and car buffer.
  3. Guide Rails: Contractor shall clean and paint the shank and base of the

T-Section of the guide rails with one field coat of black rustoleum.
4. Equipment Areas: Contractor shall paint the machine room and pit floors.
5. Field Refinishing: Contractor shall finish any metal work provided.
6. Field Retouch: Contractor shall paint surfaces damaged during installation with the original color and blend-out any variations.

- Field Quality Control:
  1. General: Contractor shall have the work at the location checked during the course of the installation.
  2. Progress Reviews: Contractor shall provide personnel for review. Corrective work required shall be accomplished as directed.
  3. Inspections: Contractor shall complete all corrective work identified by Code Authority during acceptance inspection prior to Acceptance Review.
  4. Acceptance Reviews: Contractor shall provide personnel for reviews. Contractor shall complete all corrective work identified prior to Final Acceptance Reviews.
  5. Final Acceptance Reviews: Contractor shall provide personnel for reviews to verify completion of punchlist.
  6. Warranty Review: Contractor shall provide personnel for one warranty review.
  7. Additional Reviews: Contractor shall compensate Owner for reviews should all corrective work identified not be completed as required.
- Warranty Service:
  1. General: Contractor shall service the elevators from start of the Installation Period through one year from Final Acceptance of last elevator.
  2. Program: Contractor shall provide all service, repair and adjustment. Contractor shall also provide service logs, callback logs and repair logs for the warranty period.
  3. Callbacks: Contractor shall provide emergency callback service 24-hour, 7-day-a-week at no additional cost. Contractor shall have a mechanic at the location within two (2) hours during regular hours and within two (2) hours for all other callbacks after notification to the Contractor.
  4. Vandalism: Owner shall be responsible for service costs due to vandalism.

142400 HYDRAULIC ELEVATORS

- Summary:
  1. Specify the scope of work in terms of numbers and groups of elevator.s and define the applicable components from the following list:
  2. Hoist way entrances, operational and control systems, ADA provisions, power unit assembly, jack unit assemblies, door operation systems, door protection systems, car assemblies, cab assemblies, signal system, furnishing of service/diagnostic laptop computer, providing adjuster level training and providing one year service warranty.
- Machine Room Work Provided by Others:
  1. Enclosure: Fire-rated walls according to the code shall be provided to isolate elevator equipment from other equipment.
  2. Access: Fire-rated door shall be provided which is self-closing and self-locking.
  3. Lighting: Adequate lighting shall be provided in the machine room. One light switch will be provided on the lock-jamb side of the machine room entrance door.
  4. Cooling: Air conditioning shall be provided to prevent room from exceeding the maximum equipment operating temperature requirements.
  5. Heating: Heater shall be provided to prevent room from falling below the minimum equipment operating temperature requirements.
  6. Duplex Outlet: One duplex outlet with dedicated circuit shall be provided in the room.
- Hoist-way Work by Others:
  1. Enclosure: Fire-rated wall shall be provided. Front wall shall be constructed after entrance frames have been installed.
  2. Alignment: Hoist-ways shall be provided which is plumb within 1/2 inch.
  3. Painting: Exposed side of hoist-way walls shall be taped and painted.
  4. Projections: Beveled guards shall be provided where the side or rear wall projects, recedes or is set back more than 2 inches.
  5. Pit Access: Ladders shall be provided in pits.
  6. Venting: Venting shall be provided to prevent accumulation of smoke and gases as required.
  7. Sump Pump: Refer to Standards Section 221429 (Sump Pumps).
- Electrical Requirements by Others:
  1. Mainline Disconnects: One lockable, fused three-phase mainline disconnect of specified voltage shall be provided for each elevator in the machine room.
  2. Cab Lighting Disconnect: One fused single-phase service with switch shall be provided for the elevator in the machine room.
- Cab Flooring:
  1. Flooring: Shall be provided in elevator cabs by general contractor.
- Cab Communications Requirements:
  1. Telephone Service: Specify the electrical contractor to provide ¾ inch conduit, from the nearest telephone closet (FDF), 4 pair CAT 5 telephone cable and a "D-MARK" junction box near the controller of each elevator for the purpose of providing ADA compliant telephone service in each cab. Final trimming, testing

and programming shall be performed by University Telecommunication Department.

2. Emergency Telephone Device: Standard University Emergency Telephone Unit (ETU), hands free, ADA compliant, will be provided by the University. Elevator contractor shall make necessary cut out, and provide mounting flanges with 4 tapped holes, so that the unit could be secured flush to either the front return/entrance swing column unless shown otherwise on drawings. The University will loan a prototype of the ETU to the elevator manufacturer contractor for making proper cut outs and mounting reinforcement mechanism.

- Quality Assurance:
  1. Qualified Bidders: Contractor shall be required to submit the following certified information with pre-qualification documents:
     a. Contractor is currently engaged in the manufacturing of elevator equipment, installation and repairs of elevators and has been for the previous twenty-five (25) years.
     b. Contractor shall have technical qualifications of at least ten (10) years installing microprocessor-based elevator equipment. Qualification shall be based on having trained supervisory and installation personnel and the facilities to install the elevator equipment proposed in the Chicago area.
     c. Contractor shall submit a list of installations totaling 100 completed elevators where the elevator equipment was similar to specified for this installation.
     d. Contractor shall submit a list of five or more local (in the Chicago area) installations where all the elevator equipment similar to specified herein has been completed.
     e. Contractor will provide all major components manufactured by his company for unified responsibility.
     f. Contractor is prepared to furnish to the University the service laptop PC needed to troubleshoot, service and test the controller, door operator and signals and that he is prepared to update the servicing laptop at no cost to the university. Also, that he is prepared to provide adjuster level training to University's elevator mechanics in the use of the service laptop.
- Code Compliance:
  1. General: contractor shall comply with most-stringent applicable provisions of the following Codes, Standards and Laws including revisions and changes in effect on dated of these specifications.
  2. Elevator:
     a. ASME A17.1 - Safety Code for Elevators and Escalators.
     b. ASME A17.2 - Inspector's Manual.
     c. ASME A17.3 - Safety Code for Existing Elevators and Elevators.
  3. Electrical:
     a. NFPA 70 - National Electrical Code.
  4. Building:
     a. City of Chicago Building Code
  5. Life Safety:
     a. NFPA 101 - Life Safety Code
     b. City of Chicago Fire Prevention.
  6. Handicapped accessibility:
     a. Americans with Disability Act.
     b. Illinois Environmental Barriers Act.
     c. ANSI A-117.1 - Specifications for making Building and Facilities Accessible to, and Usable by, the Physically Handicapped.
  7. Laws: Any other Ordinances and Laws applicable within the governing jurisdiction.
- Pre-Installation Submittal:
  1. General: Require the contractor to assemble complete submittal package within 15 days of Award of Contract.
  2. Product Data: Require the Contractor to submit six (6) copies of the manufacturer's specifications and installation instructions for each product furnished, especially the elevator car enclosure, machine room layout and hoist-way entrances.
  3. Power Data: Require the Contractor to provide electrical calculations for all three-phase and single-phase feeder requirements.
  4. Test Data: Require the Contractor to provide certified laboratory test reports on components as specified or required by referenced codes.
  5. Key Switches and Keying: Require that the elevator shall furnish "BEST" key switches and that the contractor shall furnish cylinders with construction cores. Also, specify the contractor shall furnish to the University the construction core control key. University will key the locks according to UIC Facilities Management procedure.
  6. Material Samples: Require the contractor to furnish three (3) samples of each material furnished.
  7. Initial Shop Drawings: Require contractor to submit one (1) mylar and six (6) copies of the equipment arrangement in the machine room, pit and hoist-way, provide plans, elevations, sections and details of assemblies, erection,

anchorage, and equipment location for review and approval by A/E.
8. Submittal Response: Specify the one Mylar and two copies shall be returned to the Contractor within 10 days. Submittal response is not justification for revision of delivery or installation schedules without prior written notification
9. Revised Shop Drawings: Specify that contractor shall incorporate changes and return one copy within 7 days.

- Permits, Inspections and Reviews:
  1. General: Specify that contractor shall coordinate all inspections and reviews with University and City of Chicago Bureau of Elevator Inspection.
  2. Permits: Specify that contractor shall obtain and pay for permits, licenses and inspection fees necessary to complete the elevator installation.
  3. Inspections: Contractor shall make all tests required by the referenced codes and/or inspection authorities. Contractor shall notify inspection authorities with sufficient notice and have inspection performed prior to reviews. Inspection delays are not justification for revision of installation schedules without prior written notice.
  4. Reviews: Contractor shall provide the personnel for acceptance reviews and final reviews indicated in the Contract Documents. Contractor shall provide 7 days notice to the Owner for each review.
- Post-Installation Submittal:
  1. General: Contractor shall assemble complete submittal package within 30 days of final acceptance of the final elevator.
  2. Final Shop Drawings: Contractor shall provide four (4) complete sets of "AS INSTALLED" drawings. All changes shall be revised on the manufacturer's drawings. No hand written changes will be accepted.
  3. Electrical Wiring Diagrams: Contractor shall provide six (6) complete sets of "AS INSTALLED" electrical wiring diagrams (EWDs). All changes shall be revised on the manufacturer's drawings. No hand written changes will be accepted.
  4. Maintenance Manuals: Contractors shall provide four (4) copies of neatly bound manuals including instructions explaining all operating features, parts lists, recommended spare parts, lubrication charts and recommended maintenance schedule. Contractor shall also provide three (3) separate copies of the adjustment, system overview, service tool and troubleshooting manuals.
  5. Keys: Contractor shall provide the construction core key and three (3) sets of properly tagged keys to operate all keyed switches and locks upon completion of the first elevator.
  6. Service Tool: Elevator Contractor shall furnish to the University two (2) laptop PC service tool with necessary software needed for adjusting, trouble shooting and performing safety and operational tests. It must be emphasized that the service tool shall be used exclusively by University elevator mechanics and it shall be used only for the elevator(s) provided under the scope of this project. The service tool shall be delivered to the University elevator foreman on or before the training session described by these standards. All necessary updating of this tool will be performed at no cost to University.
- Warranty:
  1. Period: Contractor shall guarantee that the materials and workmanship of the elevator equipment installed under these specifications shall be first-class in every respect. Contractor shall make good all defects, not due to ordinary wear and tear or improper use, which may develop within one year after the final acceptance.
  2. Periodic Examination: During the Warranty period the contractor shall lubricate all parts, examine all components of the elevators for conformance with specified design features such as, the door timings, checking bulbs of signals, group operation, speed of elevator, etc. The periodic examination will be conducted at least for one (1) hour every month for each elevator. Prior to performing the examination the contractor shall notify the UIC elevator foreman at least 2 days advance of the scheduled examination date. Failure to provide this examination will result in proportionate extension of warranty period.
  3. Service: Contractor shall provide call back warranty service at no cost to the University, with a response time not to exceed 2 hours, as follows:
     a. Maintenance work, including 24 hour-per-day, 7 day-per week emergency call back repair service, shall be performed by trained employees of the elevator contractor.
     b. Contractor will maintain an accurate log of all service calls, including details of the malfunctions and repairs performed.
     c. At the end of the warranty period the service call log will be turned over to the University Elevator Foreman.
  4. End of Warranty period Review: Contractor shall provide personnel for one warranty review. Owner may schedule this review anytime during the warranty period. Contractor shall provide any modifications to the elevator equipment and any adjustment necessary to meet requirements of the Contract Documents identified during the warranty review within 30 days of notification.
- Training:
  1. General: Elevator Contractor shall provide training to representatives of the

Owner as follows:
2. On-Site: Contractor shall provide two (2) adjuster level training sessions of 40 hours each to UIC elevator mechanics on University premises. UIC Facilities Management will make necessary on-campus/on-site arrangement for this training. Training shall include detailed overview of operational control system, motion control system, door control system, signal system, trouble shooting, servicing and periodic maintenance required. This training shall also include the training in the use of the Laptop Service Tool for adjusting, testing, down loading operational history, programming floors, etc.

- Specify the following for each elevator:
  1. Quantity.
  2. Type.
  3. Capacity.
  4. Speed.
  5. Stops.
  6. Openings and Landings.
  7. Floors Served.
  8. Travel.
  9. Entrance Size.
  10. Entrance Type.
  11. Platform Size.
  12. Cab Height.
  13. Door Type.
  14. Operation System.
  15. Power Characteristics.
  16. Special Features.
- Approved Manufacturers: Specify that elevators shall be (pre-engineered, customized or combination of the two) products from the following manufacturers:
  1. Otis.
  2. ThyssenKrupp.
  3. KONE Inc.
- Design Parameters: The elevator system shall be designed, installed and adjusted to meet the following requirements:
  1. Flight Time: The elevators shall arrive at the next typical floor with the doors open two-thirds within (calculated flight time) seconds from the start of door closing movement. This shall be accomplished regardless of load or direction of the elevator.
  2. Door Motion Times: The elevators shall open its doors within (calculated door open motion time) seconds. The elevators shall close its doors within (calculated door close motion times) seconds or the minimum allowed by Code, whichever is greater. Door times are measured from the start of movement until movement is stopped.
  3. Floor Accuracy: The elevators shall stop within 3/8" of floor regardless of load or direction and re-level to within 3/8" during loading/unloading.
  4. Speed: The elevators shall operate within 10% of the contract speed regardless of load or direction.
  5. Ride: The elevators shall operate smoothly, with less than 15 mg horizontal acceleration, less than 2.0 feet per second-squared vertical acceleration and less than 4.0 feet per second-cubed vertical jerk.
  6. Noise: The elevators shall operate quietly, with less than 55 dBa within the cab with the doors closed, 60 dBa with door operation and 65 dBa within the machine room. Noise is measured with a Dranatz Sound Meter on the C scale with the background noise less than 45 dBa.
  7. Electrical:
     a. Mainline Feeders: The elevator shall have a starting current of less than (calculated stalling current) amps and a running current of less than (calculated running current) amps with the three-phase incoming voltage being maintained within 6 10% of 480 Volts AC and within 3% of 60 cycles.
     b. Mainline Harmonics: The elevator shall add not more than 5% harmonic distortion and shall meet the requirements of IEEE 519.
     c. Lighting Feeders: The elevator shall have a lighting and fan current of less than 20 amps with the single-phase voltage being maintained within l0% of 120 Volts AC.
  8. Environment:
     a. Temperature: The elevators shall be capable of operating properly with the temperature between 55 and 95 degrees Fahrenheit.
     b. Humidity: The elevator shall be capable of operating properly with the humidity being maintained below 90% non-condensing in equipment room.
  9. Heat Emissions:
     a. Machine Room: The elevator shall not produce more than (calculated equipment heat emissions) BTU's total in this area.
     b. Hoist-way: The elevator shall not produce more than (calculated equipment heat emissions) BTU's total in this area.
- Control Systems:
  1. Operational Control:
     a. Group Operation: Provide group operational control to operate all the

elevators in each group automatically in response to car and hall calls. The elevators shall be assigned calls as they are registered. The closest elevator shall be assigned a hall call based on the estimated time of arrival (ETA). Penalties shall be given to long established hall calls and bonuses for coincident calls. The elevator shall stop for hall calls only in the direction of travel. The elevator shall reverse automatically in response to a hall call in the opposite direction of travel. The elevator shall reverse without door cycle after hold open time has expired when there is no further demand in the direction of travel and shall close after the additional hold open time has expired. The elevators shall zone after the last call is answered. There shall be one zone for each elevator in the group. The lobby zone shall be the first zone filled.

b. Firefighter's Service Operation: Provide means to operate the elevators during an emergency. Also provide connections for future smoke detector activation of lobby and alternate floor automatic return.
c. Inspection Operation: Provide means to operate the elevator at reduced speed from the top of the elevator. Activation of Inspection Operation shall remove the elevator from service.
d. Independent Service Operation: Provide means to operate the elevator in response to only car calls. Close doors by holding a car call until doors are completely closed. Activation of Independent Service Operation shall remove the elevator from service. The elevator shall park with the doors open at the last floor served.
e. Hoist-way Access Operation: Provide means to operate elevator at the top and bottom terminals at reduced speed with both the hoist-way doors and the car doors open. Terminal access shall be zoned.
f. Car-To-Terminal Operation: Provide means to initiate a demand at e terminal when the access key switch is activated. The elevator shall arrive at the terminal without activating the hall lantern or canceling the hall call. The elevator shall remain at the terminal for 15 to 30 seconds to allow the elevator to be placed on inspection operation. In the event that the elevator not be removed from service during the allotted time, the elevator shall return to group operation.
g. Oil Temperature Control Operation: Provide means to maintain proper operating temperature of hydraulic oil for consistent operation of the elevator. When oil temperature is detected below the proper range and there are no hall calls or car calls, the elevator shall be automatically lowered to the lowest landing and with the doors closed, oil may be bypassed with the pump motor running until the oil is within the proper range. The elevator shall immediately respond to any hall calls or car calls and shall return this feature when all calls have been answered.
h. Delayed Operation: Provide means to remove an elevator from group operation in the event that it is delayed and cannot respond to demands.
i. Programmed Shutdown Operation: Provide means to stop the elevator at the next floor, open the doors and remove the elevator from service. The controller shall prevent the operation of the elevator until the problem is manually reset. This operation shall activate by the oil over-temperature monitor, machine room over-temperature monitor and reduced incoming power monitor.
j. Hall Button Failure Operation: Provide means to maintain the registration of hall calls in the event all the elevators are removed from service for less than 5 minutes except firefighter's service feature. After 5 minutes all hall calls shall be canceled and remain canceled. The timer shall be reset every time one elevator is back in service.
k. Power Loss Operation: Provide means to automatically return one elevator to the lowest landing in the event of a power loss. After the elevator has returned to the lowest landing, the elevator shall open and the elevator shall be removed from service until power is restored. The open door button shall remain operational after doors are closed.
l. Back-up Operation: Provide means to maintain elevator service in the event that the control system cannot assign hall call demands.

2. Motion Control:
   a. Automatic Operation: Provide motion control which automatically decelerates. Levels and stops the elevator in response to a call.
   b. Reduce Current Starting Operation: Provide means to start the power unit with reduced current by utilizing a wye-delta configuration for starting the pump motor or utilizing solid-state starting of the pump motor.
   c. Re-Leveling Operation: Provide means to level the elevator after the elevator has stopped to maintain floor accuracy.
   d. Low Oil Operation: Provide means to monitor for low oil in the tank. When low oil is detected. The elevator shall be automatically lowered to the bottom terminal. Open the doors and remove the elevator from service until manually reset.
   e. Over-travel Limiting Operation: Provide means to prevent the operation of the elevator when it travels beyond the leveling zone at a terminal floors. The limits switches shall operate quietly.

3. Door Control:
    a. Automatic Operation: Provide door control which automatically opens and closes.
    b. Force Limiting Operation: Provide means to open the door pressure while closing to a maximum of 30 pounds (measured from rest) and a maximum of 7.5 foot-pounds kinetic energy.
    c. Reduced stall Force Operation: Provide means to reduce the force exerted on the doors during a stall condition. Door pressure shall be zero pounds after one second.
    d. Reduced Speed Closing Operation: Provide means to reduce the speed during closing to a maximum of 2.5 foot-pounds kinetic energy. Doors shall close at reduced speed during Firefighter's Service as required by the code.
    e. Door Hold Operation: Provide separately adjustable timers to vary the time the doors hold open as follows:
4. Car Call Timer: The amount of time the doors shall be held in response to a hall call shall be between 3.0 and 6.0 seconds.
5. Hall Call Timer: the amount of time the door shall be held open in response to a hall call or coincidental car call shall be between 4.0 and 8.0 seconds.
6. Interrupted Screen Timer: The amount of time the door shall be held open after the screen is reestablished shall be between 1.0 and 3.0 seconds. The timer shall be reset with each interruption of the door screen.
7. Door Reversal Timer: The amount of time the door shall be held open after doors are fully reopened. Timer setting shall be between 0 and 3.0 seconds.
8. Nudging Timer: The amount of time the doors shall be held open before sounding an audible tone. Timer setting shall be between 20 and 30 seconds.
9. Initial Timer Settings: Timers shall be initially set to the minimum allowed by handicapped accessibility standards within the range. Car call and door close buttons shall have no effect on timers.
10. Door Stall Operation: Provide means to reopen doors in the event that the doors do not close all the way within 30 seconds of closing operation. Provide means to remove the elevator from service after the third unsuccessful attempt.
11. Controller Assemblies:
    a. General: Provide material from ThyssenKrupp, KONE Inc., or Otis.
    b. Microprocessor: Provide a microprocessor-base unit for operational and communication functions. Provide ThyssenKrupp TAC 20 model. KONE Inc. Miprom I, Otis Elvonic 211.
    c. Software: Provide nonproprietary type.
    d. Service Tool: Provide all service tools require for troubleshooting, adjusting and testing.
    e. Position Sensing: Provide digital solid-state type. Provide a system that does not utilize a stationary tape in the hoist-way A LED-type position indicator shall be located in the machine room.
    f. Contactors and Relays: Provide solid-state type which shall be sized to insure proper conductivity and reliable operation. Contactor shall be as manufactured by Nordic or equal.
    g. Identifications: Provide permanent markings for all components, including size and type of fuses, identical to those symbols found on the Electrical Wiring Diagrams.
    h. Isolation Transformers/Filters: Provide transformers and filters to isolate noise from the electrical system.
    i. Labeling: Provide UL, CSA or ASME A.17.5 label.

- Power Unit Assemblies:
    1. Valves: Provide a four valve unit which shall be readily accessible for adjustment. Control valves shall be solenoid operated and shall open and close gradually for smooth motion control. Provide test seal for relief valve. Provide EECO Model UV 5A or equal.
    2. Pump: Provide a non-submersible constant displacement rotary screw type.
    3. Muffler: Provide one muffler in the oil line near the power unit to reduce the pulsations and noise present in the flow of the hydraulic fluid.
    4. Vibration Sound Dampeners: Provide rubber type to isolate the power unit from the building structure.
    5. Isolation Couplings: Provide a minimum of two in the oil line.
    6. Piping/Oil: Provide a direct run from the power unit to the cylinder with a minimum of bends. Provide test data tag. Oil reservoir shall hold 10 gallons in addition to he oil required to operate the elevator.
    7. Shutoff Valve: Provide one manual type in machine room near power unit.
- Jack Assemblies:
    1. Plunger: Provide seamless steel type which is accurately ground and polished. The bottom shall be fitted with a heavy steel disc welded in place with an extended edge to prevent the plunger from leaving the cylinder. Provide steel packing gland with bronze guide bearing, wiper ring and packing.
    2. Cylinder: Provide a steel pipe which is machined. The upper end shall have a machine flange and the lower end shall have a heavy steel bulkhead. A double wrap of polyethylene tape bonded with a special corrosion resistant bonding agent shall be provided for protection.
    3. Casing: Provide PVC type filled with Niggard 160.

4. Jack Hole: Provide excavation for jack. Hole shall be plumb within I" for every 10 feet or less of depth.
5. Channel Buffers: Provide two spring type mounted to the pit channels on each side of the cylinder.
6. Shutoff Valve: Provide one manual type in pit near the cylinder.

- Door Operation System:
  1. General: Provide material from ThyssenKrupp, Moline Accessories Corporation, KONE Inc. or equal product from Otis.
  2. Operator: Provide high-speed, heavy-duty DC master type operator with digital velocity and position feedback. Provide a contact on the car door which shall prevent the operation of the elevator when the car door is not closed. Provide ThyssenKrupp HD-85 model, MAC DHP model or equal product from Otis.
  3. Headers: Provide steel type shaped to provide stiff flanges.
  4. Tracks: Provide removable bar or formed steel with contours to match the hangers. Each track shall be reversible.
  5. Hangers: Provide polyurethane-type with pre-lubricated sealed bearings which will allow vertical and lateral adjustment of the hoist-way and car door panels. Each door panel shall have two-point suspension with separate replaceable hangers. Up-thrust shall be provided to maintain alignment of the door panels.
  6. Gibs: Provide two nylon-type per door panel. Fire stops shall be properly bent down on hoist-way door panels.
  7. Interlocks: Provide an electromechanical device which shall prevent the operation of the elevator when the hoist-way doors are not closed and locked.
  8. Restrictors: Provide device which restricts the opening of the car doors outside the unlocking zone.
  9. Closers: Provide spirator or sash weight type which shall close the hoist-way doors from any open position.
- Door Protection Systems:
  1. General: Provide material from Janus Elevator Products, Inc.
  2. Door Screen: Provide infrared pulsed type which shall initiate door reopening operation. Provide Panaforty model.
  3. Controller: Provide two-relay type which shall allow reduced speed door closing operation. Provide Panacombi Mark II model.
  4. Labeling: Provide UL or CSA label.
- Car Assemblies Guide and Balance Systems:
  1. General: Provide material from ThyssenKrupp. KONE Inc., Hollister-Whitney Elevator Corp., or equal product from Otis.
  2. Car Frame: Provide steel plank, cross head and stiles. Provide new Car Top Inspection Stations with properly covered work light and 3-wire grounded-type outlet permanently mounted to the cross head of each elevator. Provide Crosshead Data Tags permanently mounted to the crosshead. Both the stations and the data tags shall be easily accessed from tile hoist-way landing.
  3. Platform : Provide wood type with paten plate isolation. Fireproof underside of platform. Recess the floor to receive specified flooring material.
  4. Car Guide Rails: Provide standard T-type steel rails with brackets for attachment to building structure. Provide any backing or intermediate tie brackets.
  5. Car Guide Assemblies: Provide roller-type which allows front-to-back and side-to-side adjustment of each guide. Each arm shall be spring mounted with adjustable stops. Rollers shall operate at less than 250 rpm. Guide assemblies shall be designed to maintain guidance with the loss of the rollers.
  6. Car Balance: Provide mounting locations and additional weight for balance of the elevator.
- Buffer Systems:
  1. General: Provide material from ThyssenKrupp, Hollister-Whitney Elevator Corp., KONE Inc., or equal product from Otis.
  2. Car Buffers: Provide oil type mounted in the pit with protective covers. Provide switch to prevent operation of the elevator should the buffer not be fully extended. Provide new test data tags.
- Hoist-way Entrance Assemblies:
  1. General: Provide material from ThyssenKrupp, Hauenstein & Burmeister, KONE Inc., Otis.
  2. Entrance Frames: Provide #4 brushed stainless steel bolted type. Provide UL label on hoist-way side of entrance frame and transom.
  3. Door Panels: Provide #4 stainless steel sandwich type without binder angles. Provide matching or integral sight guards. Provide door panels with rubber astragals to cushion impact. Provide UL label on hoist-way side of door panel. Provide 4 " high floor marking on hoist-way side of one door panel.
  4. Sills: Provide extruded silver nickel with grooved surface. Provide support angles which require minimal grouting.
  5. Entrance Markings: Provide plates on both sides of the hoist-way entrance centered 6()" above the finished floor bolted from the back of the plate through the entrance frame. All floors shall be identified by 2" high raised numbers/letters/symbols and Braille.
  6. Escutcheons: Provide hole in hoist-way door panel to allow special tool for releasing interlock for each elevator at each floor.

7. Fascia: Provide standard fascia.

- Cab Assemblies:
  1. General: Provide material from ThyssenKrupp, Eklund, Hauenstein & Burmeister, G&R, Globe Architectural, KONE Inc. or Otis.
  2. Shell: Provide reinforced 14-gage steel with black baked enamel finish. Apply sound deadening to exterior.
  3. Canopy: Provide reinforced 12-gage steel with white baked enamel finish.
  4. Suspended Ceiling: Provide six (6) translucent panels in an aluminum frame and size to match reveals between wall panels.
  5. Side and Rear Walls: Provide three panels on side walls and two panels on rear wall. A/E shall specify the materials and design of the panels.
  6. Transom: Provide #4 brushed 14-gage stainless steel.
  7. Front Return/Entrance Columns: Provide #4 brushed 14-gage stainless steel. Entrance columns shall be separate. Entire front return shall swing on concealed hinges. Provide engraving for "No Smoking", Capacity in pounds, 5 digit elevator number as specified by UIC.
  8. Door Panels: Provide #4 brushed stainless steel sandwich-type without binder angles.
  9. Sill: Provide extruded Silver Nickel with grooved surface. Setting shall allow for cab flooring material.
  10. Handrails: Provide one line of #4 brushed 2" by 3/8" stainless steel bars on all three sides with returned ends. Mounting shall be through the car walls from the back and top of handrails shall be 32" above finished floor.
  11. Emergency Lighting: Provide battery unit with solid-state charger to operate its alarm bell and a minimum of two cab lights. Lights shall be part of normal lighting system and shall properly illuminate main car.
  12. Emergency Exit: Provide hinged latch for evacuation of the elevator through the top of the elevator. Provide contact to prevent the elevator from operating when the latch is open.
  13. Ventilation: Provide Morrison "OE" multi-speed exhaust blower for proper ventilation through the cab.
- Signal Systems:
  1. General: Provide material from Adams Elevator Equipment Company Vandal Resistance Series for Dormitories and classroom buildings. Provide ThyssenKrupp fixtures for all other buildings. Typically specify one car station for each elevator. Buildings in excess of 12 stories shall have two (2) car stations.
  2. Main Car Station:
     a. Car Position Indicator: Provide 1" high digital segmented type with direction indicators representing the floor served and the direction of travel.
     b. Pushbuttons: Provide 1-1/8" flush pushbuttons with white LED illumination. Typically specify standard pushbuttons for each floor served which illuminate to indicate call has been registered. For classroom occupancy buildings specify vandal resistant buttons. Specify emergency control pushbuttons for alarm, door open, door close, telephone and floor passing signal.
     c. Pushbutton Markings: All pushbuttons shall be identified by raised numbers/letters/symbols and Braille. Floor pushbuttons and floor passing signal pushbutton shall have a 5/8" high designation in the face of each button. All other pushbuttons shall have 1/8" high designations in the face of each button for identification.
     d. Firefighter's Service Controls: Provide keyed switch, light jewel, audible solid-state signal and call cancel pushbutton.
     e. Emergency Communication: Mount vandal-resistant telephone unit provided by Owner in car station. Phone shall be programmed to signal Security Department. Phone shall be capable of operating with the remote monitoring system.
     f. Floor Passing Signal: Provide adjustable audible electronic chime tone which sounds each time the elevator passes a floor. Pushbutton shall be identified by the letter "S" and shall activate passing tone for entire trip until elevator reverses direction.
     g. Location: Pushbuttons shall be located between 35" and 48" above the finished cab floor. Emergency control pushbuttons shall be grouped at the bottom. Firefighter's Service controls shall be grouped above the pushbuttons. Emergency communication device shall be behind a round grille with 1/16" holes above the firefighter's service controls.
  3. Service Cabinet:
     a. Access: Provide a flush, keyed #4 brushed stainless steel door with window for Certificate of Inspection. Window size shall be identical to local certificate size.
     b. Controls: Provide switches for Stop, Inspection, Independent Service, Lighting and Fan. Provide test button for Emergency Lighting.
     c. Location: Cabinet shall be located above the car operating station.
  4. Hall Lanterns: Provide 2-1/2" high triangular type with #4 brushed stainless steel faceplates located adjacent to each hoist-way entrance. Provide adjustable audible electronic tone.
  5. Hall Stations: Provide one #4 brushed stainless steel stations per floor with

1-1/8" standard pushbuttons or vandal resistant with white LED illumination.
6. Firefighter's Signs: Provide one #4 brushed stainless steel sign above each hall station with wording and symbol as required by applicable code.
7. Hoist-way Access Stations: Provide switch with #4 brushed stainless steel faceplates at each terminal located adjacent to the hoist-way entrance.
8. Firefighter's Service Station: Provide at the main firefighter's floor stalled per local requirements. Engrave firefighter's service instructions as required in #4 brushed stainless steel faceplate.
9. Fire Control Panel: Provide #4 brushed stainless steel faceplate recess mounted in the main floor hall station or at a prominent location with the followings:
    a. 1/2" high LED segmented position indicators with direction arrows for each elevator.
    b. Standby power manual override key switches with collars for each elevator.
    c. Power light for each elevator.
10. Firefighter's Key Box: Provide surface mounted type with #4 brushed stainless steel door. Provide keys and mount per local requirements.

- Wiring:
    1. General: Provide material from Siecor/Republic Wire and Cable.
    2. Conductors: Provide new copper wiring throughout, including motor leads. There shall be no slices.
    3. Traveling Cables: Provide a minimum of two (2) 50 pair cables per elevator. The cables shall have a flame retardant and moisture resistant outer cover. Provide pads where necessary to prevent damage to the cables during operation of the elevator.
    4. Terminals: Provide permanent identification at all connections.
    5. Spares: Provide an additional 10% conductors for future use. Provide four additional twisted shielded pair conductors between the machine room and the main car station. Tag these conductors as "SPARES".
- Piping:
    1. General: Provide galvanized steel with removable covers.
- Initial Site Review:
    1. General: Contractor shall thoroughly review all elevator areas before commencing work.
    2. Dimensions: Contractor shall verify proper space has been provided for elevator equipment in the machine room, hoist-way and pit areas. Contractor shall also verify that these areas are ready for the installation of the elevator equipment.
    3. Clearances: Contractor shall verify proper clearances for the elevator equipment can be maintained within the space provided.
    4. Electrical: Contractor shall verify proper electrical power has been provided. Temporary power of the same characteristics as the permanent power shall be used if available.
    5. Environmental: Contractor shall verify proper operating environment has been provided.
    6. Variations: Contractor shall provide written notification of any and all conditions which will prevent producing satisfactory work within the schedule.
    7. Acceptance: Contractor shall accept conditions prior to commencement of work. Start of work shall be interpreted as acceptance of conditions.
- Transportation and Storage:
    1. General: Contractor shall properly protect equipment and architectural finishes during transportation and storage.
    2. Transportation: Contractor shall deliver and store materials in original protective packaging.
    3. Storage: Contractor shall store equipment in the machine room. Any storage outside the machine room shall be coordinated with the Owner.
- Installation:
    1. General: Contractor shall perform all work in a first class workmanship manner.
    2. Standards: Contractor shall install equipment per Manufacturer's standards and in accordance with referenced codes.
    3. Tolerances: Contractor shall install equipment to maintain proper clearances during the operation of the elevator.
    4. Maintainability: Contractor shall install equipment so components may be easily accessed for removal during maintenance and repair.
    5. Field Welding: Contractor shall utilize certified welders. Oxidation and residue shall be chipped and cleaned away. All welds shall be wire brushed and painted with two coats of primer prior to finished coat.
    6. Unused Equipment: Contractor shall remove all unused equipment.
    7. Lubrication: Contractor shall lubricate all equipment.
    8. Wiring: Contractor shall wire equipment as indicated on the electrical wiring diagrams. Corresponding signals shall both illuminate when either button is registered.
    9. Coordination: Contractor shall coordinate all Work-Not-Included scheduled during the installation period.
    10. Protection: Contractor shall advise Owner of protection procedures to prevent damage or deterioration of work completed during the remainder of the

installation period.

- Adjustments
  1. General: Contractor shall properly adjust the components provided.
  2. Design Parameters: Contractor shall adjust the elevator to meet the design parameters.
  3. Guide Rails: Contractor shall realign car guide rails vertically with tolerance of 1/16". All connections shall be checked and tightened. Joints shall be secured without gaps. Any irregularities on the machined surface shall be filled, sanded and filed to a smooth surface.
  4. Balance: Contractor shall balance elevators front-to-back and side-to-side to equalize pressure of roller car guide rollers on the car guide rails.
  5. Guide Assemblies: Contractor shall adjust car guides to maintain roller contact with the guide rails regardless of load or position in hoist-way
- Testing:
  1. General: Contractor shall test the elevator in accordance with applicable codes.
  2. Relief Valve Setting: Contractor shall test the relief valve setting.
  3. Hoses and Fittings: Contractor shall test the hoses and fitting for a minimum of 30 seconds.
  4. Buffers: Contractor shall test the buffers with full load at maximum speed.
- Painting and Finishes
  1. General: Contractor shall provided painting and finishing of materials provided.
  2. Equipment: Contractor shall clean and paint all equipment which is provided with one coat of installer's standard enamel unless the equipment has a baked enamel or special architectural finish. Stencil paint 4" high elevator number on the mainline disconnect, car lighting disconnect, each control cabinet, crosshead and car buffer.
  3. Guide Rails: Contractor shall clean and paint the shank and base of the T-Section of the guide rails with one field coat of black rustoleum.
  4. Equipment Areas: Contractor shall paint the machine room and pit floors.
  5. Field Refinishing: Contractor shall finish any metal work provided.
  6. Field Retouch: Contractor shall paint surfaces damaged during installation with the original color and blend-out any variations.
- Cleanup:
  1. General: Contractor shall keep work areas orderly and free from debris during the installation.
  2. Daily Removal: Contractor shall remove packaging and other materials on a daily basis as equipment is installed.
  3. Daily Cleaning: Contractor shall clean work areas on a daily basis of dirt, oil and grease.
  4. Final Cleaning: Contractor shall clean machine rooms, controllers, hoist-ways, pits, hoist-way equipment, hoist-way entrance assemblies, pit equipment, door operating equipment, cab enclosures and fixtures of dirt, oil, grease and finger marks prior to acceptance review.
- Field Quality Control:
  1. General: Contractor shall have the work at the location checked during the course of the installation.
  2. Progress Reviews: Contractor shall provide personnel for review. Corrective work required shall be accomplished as directed.
  3. Inspections: Contractor shall complete all corrective work identified by the Code Authority during acceptance inspection prior to Acceptance Review.
  4. Acceptance Reviews: Contractor shall provide personnel for reviews. Contractor shall complete all corrective work identified prior to Final Acceptance Reviews.
  5. Final Acceptance Reviews: Contractor shall provide personnel for reviews to verify completion of punch list.
  6. Warranty Review: Contractor shall provide personnel for one warranty review,
  7. Additional Reviews: Contractor shall compensate Owner for reviews should all corrective work identified not be completed as required.
- Warranty Service:
  1. General: Contractor shall service the elevators for one year from Final Acceptance of last elevator of the group.
  2. Program: Contractor shall provide all service, repair and adjustment. Contractor shall also provide service logs, callback logs and repair logs for the warranty period.
  3. Callbacks: Contractor shall provide emergency callback service 24-hours, 7-days-a-week at no additional cost. Contractor shall have a mechanic at the location within two (2) hours during regular hours and within two (2) hours for all other callbacks after notification to the Contractor.
  4. Vandalism: Owner shall be responsible for service costs due to vandalism.

143100 ESCALATORS

- Rated Speed: 90 ft./min.
- Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of escalator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective

components, lubrication, cleaning, and adjusting as required for proper escalator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, 7-day-per-week emergency callback service.
    a. Response Time: Two hours or less.

- Subject to compliance with requirements, provide escalators by one of the following preferred manufacturers.
    1. Dover Elevator Systems.
    2. Fujitec America, Inc.
    3. Montgomery KONE Inc.
    4. Otis Elevator Co.
    5. Schindler Elevator Corp.
    6. Thyssen Elevator Group North America.
- Optional Features:
    1. Fault Indicator: Provide escalators with a microprocessor unit that monitors safety devices, motor temperature, and escalator speed and records in nonvolatile memory date, time, and device identification if a safety device is activated or escalator malfunctions. Provide built-in unit to display recorded information.
- Instruct Facilities Management maintenance personnel in proper use, operation, and daily maintenance of escalators. Review emergency provisions, including procedures to be followed at time of operational failure and other building emergencies. Train Facilities Management maintenance personnel in procedures to follow in identifying sources of operational failures or malfunctions. Consult Facilities Management on requirements for a complete escalator maintenance program.

144216 VERTICAL WHEELCHAIR LIFTS

- Rise shall be no more than 12 feet.
- Rated load shall not be less than 450 pounds.
- Rated speed shall be no more than 30 feet per minute.
- Enclosures shall be provided to prevent access to underside of lift when the unit is in the up position.
- Matot and Concord are the preferred manufacturers.

BUILDING STANDARDS

DIVISION 21 -- FIRE SUPPRESSION

211100 FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

- All pipes going through walls or floors shall go through sleeves, and the openings in the sleeves shall be fire caulked.

BUILDING STANDARDS

DIVISION 22 -- PLUMBING

220516 EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

- Piping expansion and contraction shall be accommodated via the use of expansion loops only. Mechanical expansion shall not be allowed.

220519 METERS AND GAUGES FOR PLUMBING PIPING

- Digital solar thermometers shall be installed upstream and downstream of all air and liquid temperature systems and subsystems for the purpose of maintenance and troubleshooting.
- Gauges shall be installed before and after all equipment to aid in troubleshooting and maintenance.
- Operating pressure scale to be centered at the top of the gauge.
- Pressure sensitive gauge tubing to be looped to prevent visual flutter of the indicator.
- Petes plugs are not acceptable in lieu of gauges.
- All fans and air handling units shall have solar temperature gauges for the discharge air, return air and outside air.

220523 GENERAL DUTY VALVES FOR PLUMBING PIPING

- Gate valves 2" and smaller: 150 lb. bronze, rising stem, screwed ends, ASTM B 61 (B62 for domestic water) bronze body and union bonnet, solid wedge disc, and painted malleable iron wheel. Design shall allow repacking under pressure. For use in steam condensate, chilled water, hot water, and fire protection.
- Gate valves 2-1/2" and larger: Iron body, bronze trim, flanged ends, OS&Y, ASTM A 126 Class B ferro steel body and bonnet, solid cast iron disc with bronze trim, replaceable bonnet bushing, 2 piece ball-type gland. Design shall allow repacking under pressure. Wheel shall be malleable iron. For use in steam condensate, chilled water, hot water, and fire protection.
- Globe valves 2" and smaller: 150 lb. bronze, screwed end with ASTI B 62 bronze body, union bonnet, composition disc, and painted malleable iron wheel. For use in steam condensate, chilled water, hot water, and fire protection.
- Globe valves 2-1/2" and larger Flanged end with ASTM A 126 Class B ferro steel body and yoke bonnet, bronze disc, stem, stem hole bushing and bronze renewable body seat rings, and malleable iron wheel. For use in steam condensate, chilled water, hot water, and fire protection.
- Check valves 2" and smaller . Y pattern, bronze, body, 200 lb, SWP, screwed ends and cap. For steam, chilled water, hot water, domestic water and fire protection systems.
- Check valves 2-1/2" and larger for domestic water: Spring loaded, center guided. Check valves shall be wafer type for 6" and smaller type, and flanged type for 8" and larger. Check valves shall have semi-steel body and bronze trim, and shall be designed for pressure service required but not less than 125 psi. For steam, chilled water, hot water, domestic water and fire protection systems.
- Check valves for sump pumps and ejectors: Iron body, bronze trim, bolted cap, renewable and regrindable bronze seat ring, composition disc, with lever and weight or lever and spring, flanged ends.
- Refer to 230553 Identification for HVAC Piping and Equipment Section for valve tag identification.
- High Performance Butterfly Valves: carbon steel body with stainless steel disc, stainless steel stem with top and bottom alignment bearings, ANSI 1 Class 125/150 flanges. Teflon seats and seals for use in chilled water systems.
- Plug Valves: ASTM A 126, Class B, cast iron body, bolted bonnet, teflon-coated plug, 200 psi WOG rating, threaded ends. For use in compressed air systems.
- Pressure Relief Valves: Pressure relief valves shall be self-closing type, conforming to ASME Boiler code, and shall be provided with non-corrosive interior operating parts with valve seats and high temperature silicone. Valves shall have test levers. Valves shall be sized in accordance with ASME requirements. Refer to contract Drawings for capacities of systems and required set points.
- Compressed air relief valve shall be the self-operated, tamper-resistant type designed to keep instrumentation on line in case of supply overpressure. The relief valve shall be installed in an in-line, flow-through arrangement with no remote vent piping. Valve shall have aluminum body, steel spring, stainless steel trim, nitrile diaphragm, and threaded ends, and be suitable for 250 psig and 150ºF.
- Water Pressure Reducing Valve: Water pressure reducing valves shall have bronze,

renewable stainless steel seats, stainless steel strainers and high temperature diaphragms. For potential use in chilled water and low temperature water systems.
- Fire Hose Valve: Fire hose valves shall be similar to the following catalog number which is based on Potter-Roemer. Valve shall be No. 4065, 2-1/2".

221000 PLUMBING PIPING AND PUMPS

- All pipes going through walls or floors shall go through sleeves, and the openings in the sleeves shall be fire caulked.
- Where dissimilar metals are used, use 'Clearwater' or 'Perfection Nipples' in place of dielectric.

221116 DOMESTIC WATER PIPING

- All domestic water piping and meters supplied to buildings shall be installed as per City of Chicago Code. Provide gate valve beyond meter for University use.
- Cold water storage tanks are to be cathodically protected.
- The domestic water distribution system in buildings requiring a booster pump shall have electric driven horizontal centrifugal type pumps, coupling guards, and control cabinets incorporating all necessary control devices, including combination starters with fused disconnects; gauges, pipe and fittings, low pressure cut-off switch, valves, auto pressure regulation, controls for remote monitoring via a Building Automation System (BAS), and accessories for a complete installation. Booster pumps will be designed so as to not interfere with the water usage in other buildings or for other purposes.
- Branches and risers shall be provided with full port shut-off valves. In copper systems, valves should be full in-line port (F.I.P.) with copper sweat adaptors. Sections with large quantities of water shall be provided with a drain valve, nipple, and cap to facilitate draining of the section. Drain valves are to be F.I.P. type valves. Hose valves are not permitted. Isolation valves and drain points shall be indicated on the drawings.
- All isolation valves shall have an associated drain valve assembly as described above.
- Horizontal sections shall have a drain valve. Each branch valve shall have a corresponding isolation valve.
- No water piping shall be run buried under interior floor slabs on grade or in floor slabs.
- Solder shall be lead free. An acceptable product is Bridgit-Canfield Lead-Free solder.

221119 DOMESTIC WATER PIPING SPECIALTIES

- Strainers:
    1. Strainers shall be hard piped to floor drains
- Pipe Sleeves:
    1. Where pipes pass vertically through floors or beams, provide steel pipe sleeves with interior diameter ½ in. larger than the exterior diameter of the pipe (including insulation passing through the sleeve) with bottom flush with construction and top projecting 1 - ½ in. above floor.
    2. Where piping is insulated, allowance in sleeve diameter shall be provided for insulation to pass through undisturbed.
    3. Where pipes pass horizontally through walls, beams or columns, provide sleeves with interior diameter ½ in. larger than the exterior diameter of the pipe (including insulation passing through the sleeve). Ends of sleeves shall be flush with finished wall surfaces.
    4. All sleeves shall be set during the construction of the building and shall be perfectly plumb or level. Locating and setting shall be included in the appropriate contract division.
    5. Pipe sleeves 3 in. and larger in masonry or concrete construction shall have steel anchor lugs welded to the pipe.
    6. Sleeves through floors shall be water tight and compatible with assembly rating.
    7. All sleeves and inserts shall have a coat of "rust inhibitive" paint before installation.
    8. Sleeves through non-rated assemblies shall be Schedule 40 black steel pipe.
    9. Sleeve fire rating to be greater than or equal to assembly rating.

221200 FACILITY POTABLE WATER STORAGE TANKS

- Do not separate potable and non-potable water unless approved by the university plumber and Safety Office.
- Potable water storage tanks are to be cement lined.

221316 SANITARY WASTE AND VENT PIPING

- All animal waste piping to be Dur-Iron.
- Soil piping to be extra heavy cast iron below slab on grade and exterior applications.
- Copper piping (where applicable) to be type L only.
- Galvanized steel piping to be Schedule 40.
- Glass piping shall be used where required by Code.

221319 SANITARY WASTE PIPING SPECIALTIES

- Cleanouts:
    1. Exposed drains: Clean outs for exposed drains shall have cast iron ferrules with raised head brass plugs, or as required for the specific application.
    2. Concrete floors: Clean outs located in concrete floors shall be nickel bronze top.
    3. Vinyl tile floors: Clean outs located in tile floors shall be inlay type with recessed access cover and frame.
    4. Walls: Clean outs located in walls shall be caulked, screwed, and shall be provided with stainless steel cover plates.

221319.13 SANITARY DRAINS

- Floor Drains for Toilet Rooms, Stair Wells and Finished Areas:
  Cast iron body with integral seepage pan and clamping collar. Strainer shall be type Y cast nickel bronze, 9" x 9" size adjustable top with square openings and vandal proof nickel bronze screws.
- Area Drains:
  Cast iron with flat top, heavy duty grate and secondary strainer in all area ways subject to traffic. Cast iron drain with dome grate and screen for area ways that are not subject to traffic or walkways.
- Floor drain requirements:
    1. Each toilet room shall be provided with 1 or more floor drains located and set in a manner to intercept overflow water.
    2. Floor drains shall be provided at the lowest level of all exterior stairs.
- Funnel-Type Drains:
    1. Cast iron body with integral seepage pan and clamping collar, nickel bronze grate, and 4" diameter funnel extension and strainer head.

221329 SANITARY SEWERAGE PUMPS

- Sewage ejectors inside the buildings shall be duplex type. Discharge lines shall run to an external manhole and shall not be connected to any portion of the sewer system within the building.
- Pumps handling sewage or other waste materials should be of the non-clog type. Mechanical ventilation is necessary for the dry and/or wet wells in order to prevent gaseous emissions escaping into the building or other habitable areas.
- Sewage Ejectors:
    1. 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 (or rubber coated mercury float switches), duplex gas-tight steel floor plates, low speed motors (1750 rpm or less) mounted above floor plate, and float guide pipes.
    2. Combination fused motor starters with lead/lag pump control, pump operating pilot lights, and automatic lead pump selector switch with seven day timer, completely pre-wired in a wall mounted control panel shall be furnished and installed for each pump installation. Lead pump shall be alternated once each seven days for one day to exercise the lag pump (i.e. lead pump runs for six days, lag pump acts as lead pump for one day of every seven days.)
    3. A high water float switch and alarm bell shall be provided for each sewage ejector or sump pump installation. Alarm bell to sound at the pump and the Central Building Automation System.
    4. Pump installations shall not be used by any contractor during the construction phase. The installing contractor shall put the pumps into service when the building is accepted for occupancy by the University.
    5. Horizontal swing check valves shall be installed on each individual pump discharge. Spring-loaded check valves in vertical piping are not acceptable.
    6. Check valves for sump pumps and ejectors: iron body, bronze trim, bolted cap, renewable and regrindable bronze seat ring, composition disc, with lever and weight or lever and spring, flanged ends.

7. The pump motors should be mounted at the floor line and should not be submerged.
8. Sewage ejectors should be designed to handle plumbing fixtures serving basement areas and should not receive sewage from floors above grade. (Floors above grade shall be designed to flow by gravity to the outside sewage systems.)
9. The design document drawings should have a detail of the ejector system.

- Basins:
  1. Basins shall be cast iron of required size. The basin shall be constructed so that the basin covers will provide a gas-tight installation. All bolts and studs for all basin covers shall be brass. Mud settling and blow-off basins shall be cast iron of required sizes. Rodding basins shall be similar to mud settling basins and, when located in finished floors, shall have recessed covers with bronze finishing rings of equivalent floor tile thickness integral with basin floor frame and cover. Bolts for basin covers should fit flush with finished floors. Basins shall be vented to the outside.

221413 FACILITY STORM DRAINAGE PIPING

- No unique University standards requested. Refer to Codes and Standards Section for appropriate design requirement.
- Please note: City of Chicago requires the use of Vitreous Clay Storm Piping at the building exterior.

221423.23 FATS, OILS & GREASE DISPOSAL SYSTEMS

- Oil interceptor drains shall be cast iron, triple garage basin sets, sized as required.

221426.13 ROOF DRAINS

- With gravel stops, clamping device, dome strainer, extension sleeve, under-deck clamp and lead caulked outlet.

221429 SUMP PUMPS

- Pumps for storm water drains inside the buildings shall be duplex type. Discharge lines shall run to an external manhole and shall not be connected to any portion of the sewer system within the building.
- Roof drains and area drains should not be routed to subsurface drainage sumps.
- Under no circumstances shall elevator pits be used as a collection basin for any type of drainage. The elevator pit shall contain a sump pit and sump pump and shall discharge to a sanitary open site drain.
- For elevator pits and other locations, where only a small pump can be used, a submersible type may be used. It shall be complete with a manual test button and waterproof cord and plug. A gate valve, check valve and union shall be installed in the pump discharge. Submersible type sump pumps are to be avoided for other than elevator pit service.
- 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 (or rubber coated mercury float switches), duplex gas-tight steel floor plates, low speed motors (1750 rpm or less) mounted above floor plate, and float guide pipes.
  1. Combination fused motor starters with lead/lag pump control, pump operating pilot lights, and automatic lead pump selector switch with seven day timer, completely pre-wired in a wall mounted control panel shall be furnished and installed for each pump installation. Lead pump shall be alternated once each seven days for one day to exercise the lag pump (i.e., lead pump runs for six days. Lag pump acts as lead pump for one day of every seven days.)
  2. A high water float switch and alarm bell shall be provided for each sump pump installation. Alarm bell to sound at the pump, Central Building Automatic System.
  3. Pump installations shall not be used by any Contractor during the construction phase. The installing Contractor shall put the pumps in service when the building is accepted for occupancy by the University.
  4. Horizontal swing check valves shall be installed on each individual pump discharge. Spring loaded check valves in vertical piping are not acceptable.
  5. Check valves for sump pumps and ejectors: iron body, bronze trim, bolted cap, renewable and re-grindable bronze seat ring, composition disc, with lever and weight or lever and spring, flanged ends.
  6. The pump motors should be mounted at the floor line and should not be submerged.

7. The design document drawings should have a detail of the sump and pumps.

- Basins:
  1. Sump basins shall be cast iron or fiberglass of required sizes. The basin shall be constructed so that the basin covers will provide a gas-tight installation. All bolts and studs for all basin covers shall be brass. Mud settling and blow-off basins shall be cast iron of required sizes. Rodding basins shall be similar to mud settling basins and, when located in finished floors, shall have recessed covers with bronze finishing rings of equivalent floor tile thickness integral with basin floor frame and cover. Bolts for basin covers should finish flush with finished floors. Basins shall be vented to the outside.

223500 DOMESTIC WATER HEATER EXCHANGERS

- The preferred domestic hot water system shall consist of a Tube and Bundle, double walled, water heater with steam to hot water heat exchanger.
- Where hot water is the only available heating source, (East Campus) medium temperature hot water is to be run through the outer walls of the water heater jacket.
- Hot water storage tanks are required only for high demand usage.

224000 PLUMBING FIXTURES

- Water closets shall be vitreous china wall mounted, elongated bowl, blowout type with 1-1/2 in. top spud, white open front seat, less cover, with concealed check hinge, flush valve with handle stop, vacuum breaker quiet flush equipment and chair carrier. The water closet and flush valve shall be designed and adjusted to flush the water closet with less than 3.5 gallons of water.
- NO WASHOUT CLOSETS WILL BE PERMITTED.
- Water closets shall be mounted on floor mounted carriers. Sanitary connection (nipple) between waste pipe and fixture to be made of cast iron (no substitutes will be allowed).
  1. American Standard Siphon-jet 1.6g. is the preferred model. Accessible units shall comply with State and Federal accessibility guidelines.
- Urinals shall be vitreous china wall hanging blowout urinal with jet, extended shields and trap, vacuum breaker, 1 1/4 in. top spud, wall hangers, 2 in. I.P.S. outlet connection, open passageway. The urinals and flush valves shall be designed and adjusted to flush the urinals with less than 1.5 gallons of water.
- NO WASHOUT URINALS WILL BE PERMITTED.
- Urinals shall be wall mounted on floor-mounted carriers concealed within the wall construction.
- Shower enclosures generally will be constructed in place with membrane waterproofing in the walls and floor. In the event pre-cast receptors are used for individual showers, they shall have integral membrane waterproofing and special care shall be taken to finish the wall membrane waterproofing over the top rim of the receptor. Lead safing pans for showers shall not be used. Strainer shall have a minimum free flow area of 13.25 square inches. Accessible shower enclosures shall be the same as above except to further include a lever diverting valve, 60" rubber hose, spray head, atmospheric vacuum breakers, and wall hook assembly. Special arrangements of the curbs, shower enclosure and trimmings are required in residence hall showers for students using wheel chairs.
- Mixing valve and shower head shall be for concealed piping, consisting of built-in shutoff valve, integral volume control, maximum temperature stop, replaceable Delrin cartridge including poppet-type equalizing chamber, 1 /2 in. pipe connections, shower set with chrome plated arm, flange and self cleaning circular off-the-wall shower head with ball joint, separate spray control maximum 2.5 GPM delivery rate, inlet screwed end stop valves. Valve shall be provided with either Lucite or lever handle.
- Safety showers and eyewash stations shall be located in the corridor, within 100 feet or 10 seconds travel distance of any corrosive activity and shall be clearly identified for that purpose.
  1. Water supply to the safety shower and eyewash area shall be connected to high use water lines to avoid problems with stagnant water in the line. American Standard is the preferred manufacturer.
- Mop basins shall be floor level type pre-cast terrazzo mop basins.
- Exterior sillcocks shall be of the non-freeze integral vacuum breaker type, and should be arranged around the outside of building so that 100 ft. of hose shall reach all portions of the project site perimeter. Consult Facilities Management for unusual conditions. Each sillcock will have its own isolation valve inside the building.
  1. Sillcocks shall be provided at each loading dock and trash collection area.

224700 DRINKING FOUNTAINS AND WATER COOLERS

- All drinking water coolers are to be wall-mounted.
- Accessible Units: Individually wall mounted type with stainless steel receptors. Preferred manufacturer and model: "Elkay" EBFSA-86. Mount units on floor-mounted carriers concealed within wall construction.

226000 GAS & VACUUM SYSTEMS FOR LABORATORY HEALTHCARE FACILITIES

- Laboratory vacuum pumps must be independently vented to atmosphere above the main roof. Discharge must be at least 25 feet from any air intake. Drainage type fittings shall be used in the vacuum piping, with Y fittings at branches and changes in direction having brass screw plugs to serve as clean-out openings.
- Standard weight galvanized steel pipe and screwed malleable iron galvanized fittings shall be used.

BUILDING STANDARDS

DIVISION 23-- HEATING,VENTILATING AND AIR CONDITIONING

230100 OPERATION AND MAINTENANCE OF HVAC SYSTEMS

- All construction punch list items shall have been resolved prior to system start-up.
- All manufacturers' representatives required by specification to witness equipment start-up are present.
- Domestic water systems have been certified as conforming to the Federal Safe Drinking Water Act.
- Refer to related Integrated Automation 250000 Sections.

230120 OPERATION OF HVAC PIPING AND PUMPS

- Pressure gauges shall be installed in all pumps suction and discharge piping to aid in maintenance and trouble-shooting.
- Refer to the following list of schematics for information of installation standards. If different installation is to be done university approval will be needed.
  1. High temperature hot water to hot water converter
  2. Steam to hot water converter
  3. Hot water heating coil
  4. Hot water heating coil with recirculating pump
  5. Steam heating coil
  6. Chilled water cooling coil
  7. Chilled water cooling coil with recirculating pump
  8. VAV box with reheat coil

230500 COMMON WORK RESULTS FOR HVAC MOTORS

- The equipment manufacturer of the driven equipment shall establish the size of the motors.
- Horizontal mounting is preferred. Vertical mounting is acceptable where space is limited. Refer to this Division (Division 23) for any additional requirements.

230516 EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

- Piping expansion and contraction shall be accommodated via the use of expansion loops only. Mechanical expansion shall not be allowed

230519 METERS AND GAUGES FOR HVAC PIPING

- All thermometers shall be the digital and solar type.
- Digital solar thermometers shall be installed upstream and downstream of all air and liquid temperature systems and subsystems for the purpose of maintenance and troubleshooting.
- Gauges shall be installed before and after all equipment to aid in troubleshooting and maintenance.
- Operating pressure scale to be centered at the top of the gauge.
- Pressure sensitive gauge tubing to be looped to prevent visual flutter of the indicator.
- Do not use P&T plugs to replace P&T gauges.
- All fans and air handling units shall have solar temperature gauges for the discharge, return air and outside air.

230523 GENERAL DUTY VALVES FOR HVAC PIPING

- All automatic flow valves shall come with ports for verification.
- All control valves and dampers shall be electronic modulating.
- **They shall be "proportional" and shall provide feedback to the BAS.**
- Gate valves 2" and smaller: 150 lb. bronze, rising stem, screwed ends, ASTM B 61 (B62 for domestic water) bronze body and union bonnet, solid wedge disc, and painted malleable iron wheel. Design shall allow repacking under pressure. For use in steam condensate, chilled water, hot water, and fire protection.
- Gate valves 2-1/2" and larger: Iron body, bronze trim, flanged ends, OS&Y, ASTM A 126 Class B ferro steel body and bonnet, solid cast iron disc with bronze trim, replaceable bonnet bushing, 2 piece ball-type gland. Design shall allow repacking under pressure. Wheel shall be malleable iron. For use in steam condensate, chilled water, hot water, and fire protection.
- Globe valves 2" and smaller: 150 lb. bronze, screwed end with ASTI B 62 bronze body, union bonnet, composition disc, and painted malleable iron wheel. For use in

steam condensate, chilled water, hot water, and fire protection.

- Globe valves 2-1/2" and larger Flanged end with ASTM A 126 Class B ferro steel body and yoke bonnet, bronze disc, stem, stem hole bushing and bronze renewable body seat rings, and malleable iron wheel. For use in steam condensate, chilled water, hot water, and fire protection.
- Check valves 2" and smaller . Y pattern, bronze, body, 200 lb, SWP, screwed ends and cap. For steam, chilled water, hot water, domestic water and fire protection systems.
- Check valves 2-1/2" and larger for domestic water: Spring loaded, center guided. Check valves shall be wafer type for 6" and smaller type, and flanged type for 8" and larger. Check valves shall have semi-steel body and bronze trim, and shall be designed for pressure service required but not less than 125 psi. For steam, chilled water, hot water, domestic water and fire protection systems.
- Check valves for sump pumps and ejectors: Iron body, bronze trim, bolted cap, renewable and re-grindable bronze seat ring, composition disc, with lever and weight or lever and spring, flanged ends.
- Refer to 230553 Identification for HVAC Piping and Equipment Section for valve tag identification.
- High Performance Butterfly Valves: carbon steel body with stainless steel disc, stainless steel stem with top and bottom alignment bearings, ANSI 1 Class 125/150 flanges. Teflon seats and seals for use in chilled water systems.
- Plug Valves: ASTM A 126, Class B, cast iron body, bolted bonnet, teflon-coated plug, 200 psi WOG rating, threaded ends. For use in compressed air systems.
- Pressure Relief Valves: Pressure relief valves shall be self-closing type, conforming to ASME Boiler code, and shall be provided with non-corrosive interior operating parts with valve seats and high temperature silicone. Valves shall have test levers. Valves shall be sized in accordance with ASME requirements. Refer to contract Drawings for capacities of systems and required set points.
- Compressed air relief valve shall be the self-operated, tamper-resistant type designed to keep instrumentation on line in case of supply overpressure. The relief valve shall be installed in an in-line, flow-through arrangement with no remote vent piping. Valve shall have aluminum body, steel spring, stainless steel trim, nitrile diaphragm, and threaded ends, and be suitable for 250 psig and 150ºF.
- Water Pressure Reducing Valve: Water pressure reducing valves shall have bronze, renewable stainless steel seats, stainless steel strainers and high temperature diaphragms. For potential use in chilled water and low temperature water systems.
- Fire Hose Valve:
    1. Fire hose valves shall be similar to the following catalog number which is based on Potter-Roemer.
        a. Valve shall be No. 4065, 2-1/2" rough brass, 300 lb. Valve with brass cap and chain, with threads complying with the Chicago Fire Department requirement.

230529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

- Galvanized or painted threaded rods and hangers shall be used to prevent rusting. The rod supporting the hangers, bolts and screws shall be no longer than ½" below the lower nut. Perforated strap hangers for pipe shall not be used.

230553 MECHANICAL IDENTIFICATION HVAC PIPING AND EQUIPMENT

- All pipes in the piping systems shall be identified, both where exposed in a room and where concealed from view in a chase or above a hung ceiling.
- Provide color coded banding for proper identification of pipe contents and directional flow arrow(s) decals at the following locations:
    1. Behind every access door or panel.
    2. At each valve.
    3. At each riser and/or "T" joint.
    4. At each point of entry or exit where pipe passes through walls, floors or ceilings.
    5. At intervals not exceeding 50'-0" apart on long runs.
- Engraved laminated plastic nameplates under each instrument in the control panel shall designate its function.
- Ducts and fans shall be stenciled with 1" high black letters and/or numerals. On multi-zone air handling units, ducts shall be marked near respective fans to indicate room served, capacity, and location of zone control. Fans shall be marked to indicate unit number, rooms served, actual cfm, rpm and amperage of motors under final operating conditions.
- Mechanical System Color Identification: Adhesive markers with directional flow arrow(s).

1. Red: Fire protection apparatus; control cabinets, water pipes, fire pumps, and jockey pumps.
2. Orange: Boiler produced hot water and steam piping, pressure relief piping.
3. Yellow: Natural gas piping, gas boosters and emergency generators.
4. Light Green: Chiller skins and compression tanks.
5. Dark Green: Domestic water pipes.
6. Blue Green: Chilled water piping
7. Light Blue: Pumps and motors.
8. Dark Blue: Domestic water storage, sewage ejectors and refrigerant compressors.
9. Light Gray: Condenser Water Pumps and air handlers.
10. Dark Gray: Safety rails, pipe hangers and vibration isolators.
11. Purple : Air compressors and compressed dryers and piping.
12. Black: Oil piping, fuel oil tank, water holding tanks, drain and waste lines.
13. White: Heat exchangers and chemical treatment piping.

- Placement - provide identification markers:
  1. On all pipes at 50 foot intervals.
  2. On all branches and valves.
  3. On both sides of walls where pipes pass through wall.
  4. Where pipes pass through floor.
  5. At changes of flow direction.
- Type and Size of Letters:
  Contrast shall be provided between color field and legend for readability. On overhead piping, apply markers on the lower quarter of the pipe where a view from the floor is unobstructed. Use of standard style, in sizes ½" (13mm) and larger, is recommended. Refer to Table of Sizes (below) for specific size recommendations. For identification of materials in pipes of less than ¾ in. (19mm) in diameter, and for valve and fitting identification, the use of a permanently legible tag is recommended. Apply an arrow marker at each identification marker, with arrow pointed away from legend in the direction of flow. If flow may be both ways, apply double-headed arrows.

Outside Diameter of Pipe		Size of Letters	
INCHES	MM	INCHES	MM
¾ to 1¼	19 to 3	½	13
1½ to 2	38 to 51	¾	19
2½ to 6	64 to 150	1¼	32
8 to 10	200 to 250	2½	64
Over 10	Over 250	3½	89

- Valve Tags and Numbering
- All valves shall be tagged with 1¼ in. diameter, 0.040 in. thick brass or laminated plastic tags with numbers and letters. A complete directory of valves, pump motors, controls, devices, and other equipment, giving use, location, size, and manufacturer's number of each shall be prepared with permanent ink, framed under glass, and hung in the mechanical equipment room where directed by the University.

230593 TESTING, ADJUSTING AND BALANCING FOR HVAC

- Test existing conditions prior to retrofitting. Submit results in report form to the University.
- Permanently mark the settings on valves, dampers and other adjustable devices, allowing settings to be restored. Set memory stops and lock.
- Effect adjustment of water distribution systems by means of circuit setters and balancing valves. Do not use service or shut-off valves for balancing.
- Adjust hydronic systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measuring temperature differential in conjunction with air balancing.

230713 DUCT INSULATION

- All ductwork insulation shall be in accordance with the "National Commercial and Industrial Standards" as published by the Midwest Insulation Contractors Association, with the following additional requirements.
- All ductwork insulation shall be external to the ductwork.
- Internally lined ductwork is not allowed.
- Minimum insulation thickness is 1½ inches of fiberglass. Minimum density shall be 3

lbs/ft^3.
- Supply ductwork, including flexible ducts, that conveys mechanically cooled air, shall have a vapor barrier.

230716 HVAC EQUIPMENT INSULATION

- All equipment insulation shall be in accordance with the "National Commercial and Industrial Standards" as published by the Midwest Insulation Contractors Association, with the following additional requirements.
- Any equipment that contains a fluid (liquid or gas) which is normally at a temperature of 10° F above or below the normal temperature of the room containing the equipment shall be insulated.
- Vapor barriers shall be installed on any equipment subject to condensation.

230719 HVAC PIPE INSULATION

- All pipe insulation shall be in accordance with the "National Commercial and Industrial Standards" as published by the Midwest Insulation Contractors Association, with the following additional requirements.
- In general, all domestic piping (except Fire Protection piping, medical gas, and pneumatic air) shall be insulated. All piping subject to sweating shall have vapor barriers.
- Piping to be insulated includes:
    1. Domestic water: cold, hot and return.
    2. Chilled water, supply and return.
    3. Condensate return.
    4. Roof Drains (horizontal sections only)
    5. Steam
    6. High Temperature Hot Water, supply and return refrigerant.
- Any insulated piping passing through walls shall have no reduction in insulation through the wall or pipe sleeve.
- Clevis supports and rods on insulated piping shall be insulated.
- Roller supports on chilled water piping shall isolate the roller from the pipe to prevent condensation formation on the roller assembly.

230900 INSTRUMENTATION AND CONTROL FOR HVAC

- Refer to related Integrated Automation 250000 Sections.
- Temperature Control Air Compressors:
    1. Control air compressor shall be used for no other purpose than for temperature control air supply.
    2. Compressors shall be sized to maintain adequate control air while running not more than 50% of the time. Compressors shall be duplex type to assure standby protection. Provide an automatic alternator that distributes wear between the two compressors on a 70% to 30% ratio (adjustable) i.e., lead 70%:lag 30%.
    3. A refrigerated or desiccant air dryer shall be installed on all control air systems to insure dry air.
    4. Install an oil separator and an air filter in the supply line ahead of the dryer and an air filter after the dryer of a type that can be easily serviced.
    5. Air receivers must be constructed in accordance with the ASME code and bear the ASME stamp.
- Air compressors (10hp and under) shall be air cooled. Caution shall be exercised in locating compressors, with respect to heat producing equipment and room ambient temperature.
- Provide an air pressure gauge on each receiver air tank.
- Three Valve Bypasses
    1. Provide three valve bypasses using gate or ball valves around the following devices to allow maintenance of these devices without interruption of compressed air service:
        a. All air filters, oil separators, etc.
        b. Refrigerated or desiccant drier.
- Provide a 3 valve bypass around the PRV with a second "standby" PRV in the bypass leg.
- Electrical Supply to Compressor Motors.
    1. Provide a separate set of electric feeders to each compressor motor with a separate circuit breaker for each motor in the supply panelboard or motor control center. This arrangement allows one compressor to remain in service while the other one is being serviced. Single electrical feeds to dual compressor systems are expressly prohibited.

- Compressor bodies and cylinders shall be of cast iron construction only and shall be by the following preferred manufacturers:
  1. Quincy
  2.

  De Vilbiss

230933 ELECTRIC AND ELECTRONIC CONTROL SYSTEMS FOR HVAC

- Provide a Sequence of Operations for new building systems as approved by the User.
- Provide Central HVAC Systems Display as applicable:
  1. System graphic
  2. System on/off indication
  3. System day/night mode
  4. Supply fan on/off indication
  5. Return fan on/off indication
  6. Heating coil pump on/off indication
  7. Outside air temperature indication
  8. Mixed air temperature indication
  9. Fan discharge air temperature indication
  10. Fan discharge temperature control point adjustment
  11. Supply static pressure indication
  12. Supply static pressure control point adjustment
  13. Humidity sensor
  14. Enthalpy sensor
  15. System on/off auto switch position.
  16. System day/night/auto switch position.
  17. Supply fan on/off switch position.
  18. Return fan on/off/auto switch position.
  19. Heating coil pump on/off switch position.
  20. Time of day scheduling.
  21. Start/stop time optimization.
  22. Peak demand limiting.
  23. Duty cycling (temperature and/or time based).
  24. Enthalpy optimization.
  25. Supply air reset.
  26. Chilled water reset.
  27. Hot water reset based on outdoor air temperature.
  28. Event initiated programs.
  29. Trending.

230943 PNEUMATIC CONTROL SYSTEMS FOR HVAC

- Refer to related Integrated Automation 250000 Sections.

- All pneumatic controllers, actuators and other related equipment (except sensors) shall be mounted outside of the ductwork airstream (on the "outside" of the ductwork) and located in mechanical rooms or other accessible spaces such that these components are readily accessible for maintenance, replacement or repair without requiring personnel to enter the ductwork airstream, open duct access doors or shutdown the air handling system.

230953 PNEUMATIC AND ELECTRIC CONTROL SYSTEMS FOR HVAC

- Refer to related Integrated Automation 250000 Sections.
- Use copper tubing only, except for terminations.

230993 SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

- For each mechanical system, provide the sequential operating procedure for both start-up and shut-down, a wiring diagram and operating description. Data provided should be adequate to determine sequence of operation and how various components are wired into system. Wiring diagrams shall include a legend, which identifies the symbols used in the diagram.
- Conservation of energy, minimizing life cycle and operating cost are items of prime importance to the University. (min. to be provided by UIC) Accordingly, the design of systems, the selection of electric motors and drive equipment for each mechanical system should be based on high reliability, low maintenance, high efficiency and overall low life cycle cost.
- Electrical repair parts for mechanical systems should be readily available.

- Motor control centers are preferred.

231100 FACILITY FUEL PIPING

- All pipes going through walls or floors shall go through sleeves, and the openings in the sleeves shall be fire caulked.

232000 HVAC PIPING AND PUMPS

- All pipes going through walls or floors shall go through sleeves, and the openings in the sleeves shall be fire caulked.
- All pumps have to have pressure gauges on the inlet and outlet, and if a strainer is part of the pump another pressure gauge shall be installed downstream of the strainer.
- Where dissimilar metals are used, use 'Clearwater' or 'Perfect Nipples' in place of dielectric.
- All pumps shall be installed with line size isolation valves on both sides.
- Pumps shall have line size strainers at intake with blow downs. Flow setters should not be substituted for isolation valves.
- For primary pumping application, split case centrifugal pumps are preferred over the end suction pumps.
    1. Mechanical seals are preferred and should be used where adaptable. Complete flushing arrangement shall be provided for mechanical seals and packaging.
        a. Horizontal split case pump ball bearings shall be double row on outboard. Pump casings shall have vent and drain plugs and pressure gauge tappings.
    2. Pump and motor shall be installed on a common steel or cast iron base, isolated from the building structure so that the unit will not transmit vibration to the building. Pump coupling to motor shall be flexible. Coupling shall be equipped with a guard.
    3. Inlet and outlet pressure gauges shall be provided to read differential pressure.
- In-line pumps shall be connected directly to the piping. Motor on large pumps shall be separately supported. Pumps shall not be mounted with motor shaft vertical unless required by space limitations. Provide gauge valves at in-line pump suction and discharge.
    1. Provide line size inlet strainer with blow down.
    2. Provide unions or flanges to connect pump to inlet and outlet lines.
    3. Use shaft sleeves for pumps with packing.
- Pumps shall be field aligned and/or balanced to operate at a maximum allowable vibration level of 0.15 inches per second velocity or less in any plane measured at the pump bearings.

232100 HYDRONIC PIPING AND PUMPS

- Flushing and cleaning should be under the supervision and direction of the same chemical company the Facilities Management Department uses.
- After the acceptance of installations of chilled water or hot water piping the Contractor shall fill the piping with water that matches the chemical composition of the water in the system with respect to hardness and nitrite composition.
- Except for 100% outside air AHUs, all Air Handling Units shall have air blenders.
- Separate heating systems for each of the AHUs; the perimeter heating and the booster reheat coil system should be provided.

232113 HYDRONIC PIPING

- All drain valves, strainers, dirt legs, traps, vents, etc., shall be hard piped to a floor drain.

232113.23 PROCESS PIPING

- Comfort cooling and process cooling systems are not to be mixed.

232120 PIPING SPECIALITIES

- All vents shall be dedicated vents installed at all high points and shall be goose neck, pointing straight down (drain down not up). All vent piping shall be min of 1/4" hard pipe with a 1/4" shut-off valve.
- Vents that come with all combination valves will not be considered dedicated vent and as such they will not be accepted.

- Vents in mechanical rooms shall be hard piped to a floor drain.
- All drains shall be dedicated drains and shall be at the lowest point in any systems.
- Drains in mechanical rooms shall be hard piped to floor.
- Floor drains shall be provided in all mechanical rooms and shall be within 15 feet of any air handling units.
- 4” floor drain is to be minimum size.

232123 HYDRONIC PUMPS

- ITT/Bell and Gossett pumps are preferred.

232200 STEAM AND CONDENSATE PIPING AND PUMPS

- All pipes going through walls or floors shall go through sleeves, and the openings in the sleeves shall be fire caulked.
- Hot water heating is the preferred heating method.
- It is desired insofar as possible to divide the steam distribution piping and returns within the building into separate systems to facilitate metering, and to keep as much piping as possible out of service during the summer.
- Condensate for all building steam services may be returned through a single meter, receive and pump arrangement, provided that proper flash tanks are used for higher pressure condensate (25 psi and over). Condensate must be discharged using condensate pumps at the building into a pressure return main against a head of not less than 50 psig. Where departmental billing or other cost sharing is required, provide appropriate separate metering and piping.
- Direct radiation systems shall be of the two pipe hot water type, up or down feed. Normal design shall be based on inside temperature of 70 deg. F, and outside temperature of -10 deg. F. Hot water systems may be used if separate controls are used for temperature reset schedules.
- Meters shall match existing University inventory.
- Locate in the mechanical equipment room off of the steam tunnel, accessible for reading and servicing.
- All steam traps to have testing ports.

232300 REFRIGERANT PIPING

- All pipes going through walls or floors shall go through sleeves, and the openings in the sleeves shall be fire caulked.
- All refrigerant systems shall have moisture/liquid indicators, suction link filter driers and high/low pressure shut-offs.
- Contractor to provide piping layout diagram approved by the equipment manufacturer.
- No unique University Standard for refrigerant and oil.

232400 INTERNAL-COMBUSTION ENGINE PIPING

- All pipes going through walls or floors shall go through sleeves, and the openings in the sleeves shall be fire caulked.

232500 HVAC WATER TREATMENT

- Flushing and cleaning should be under the supervision and direction of the same chemical company the Facilities Management Department uses.
- After the acceptance of installations of chilled water or hot water piping the Contractor shall fill the piping with water that matches the chemical composition of the water in the system with respect to hardness and nitrite composition.
- All new chilled, hot water and steam piping installed shall be sufficiently clean such that water samples submitted to the Facilities Management shall meet the following test limits before acceptance of piping by the University.

Chloroform Extractables	5 PPM or less
Particulate Matter	25 PPM or less on 1.2 micron media
Corrosion Inhibitors	500-1000 PPM as Nitrite
0:1	Zero
Grease	Zero
Alkalinity	±30 PPM

- Any on-site pipe cleaning shall be performed in the presence of the University Commissioning Representative.

233100 HVAC DUCTS AND CASINGS

- Less than 6" duct dimensions will not be allowed.
- All ducts going through walls or floors shall go through frames/curbs, and duct insulation shall be continued through the walls or floors. All duct opening through fire walls or floors shall be fire caulked.
- Ductwork and ductwork supports shall be designed per SMACNA (latest issues) or the more stringent of the following criteria.
- Ventilating ducts normally shall be of galvanized iron. Where corrosive acids or fumes are handled, 316L stainless steel minimum 18 gauge shall be used. Duct from dishwashers and other steam producing equipment shall be 316L stainless steel with soldered joints.
- Flexible fiberglass ducts shall not be allowed to go through any walls or floors.
- Connections between inlet and discharge openings of fans and ducts shall be made with a section of 1/16 in. thick neoprene coated fiberglass fabric. Flexible connections should not be less than 4 in. long and with at least a 1 in. slack. Connections shall have angle frames at each end for rectangular ducts, and metal tension bands for round ducts.
- Ductwork carrying mixed air should be of sufficient length prior to entering heating coils to prevent stratification. Factory fabricated air blenders may be used where space is limited but proper duct design is the preferred method of stratification control.
- 90 degree take-offs are not permitted. Use bell mouth for round ducts.

233113 METAL DUCTS

- All air-conditioning supply air duct shall be insulated.
- Use, design and construction per SMACNA.
- No 90 degree take-offs are allowed. Use bell mouth for round duct.

233116 NONMETAL DUCTS

- Use, design and construction per SMACNA.

233116.13 FIBROUS GLASS DUCTS

- Use, design and construction per SMACNA.

233300 DUCTWORK ACCESSORIES

- Dampers:
    1. Multi blade dampers shall be of opposed blade pattern.
    2. Damper Blades: Galvanized steel or 6063-T5 aluminum.
    3. Bearings: Stainless steel or base bearings.
    4. Bearing pins (axles): Stainless steel.
    5. Jackshafting: Where multiple damper sections are used (more than one damper section) jackshaft shall be used for simultaneous activation of dampers sections. A jackshaft shall be defined as a common steel shaft with outboard bearings arranged to distribute torque evenly to one section of the damper assembly.
    6. Linkages: Non concealed and accessible for maintenance.
    7. Provide access doors at both sides of dampers for maintenance.
    8. Provide access door large enough to maintain dampers.
    9. Flex duct shall not be used when pressure is in excess of 2 inches w.c.
        a. Flex duct, when used, shall not be more than 5 feet in length.
        b. Flex duct shall be used for terminal diffuser / grille connections.
- Louvers:
    1. Refer to related Integrated Automation 250000 Sections.
    2. All air intake openings shall be provided with storm proof louvers, "Z" construction, bird screen, and dampers.
    3. Intake openings shall be sized for an actual maximum face velocity of 400 FPM is preferred. Intake chambers should be equipped with watertight drip pans with draining directed to open sight drains.

233313.13 VOLUME CONTROL DAMPERS/ VALVES

- Control valves (and actuators) shall be sized for 100% shut-off against system's maximum differential pressure.
- Design criteria for sizing modulating water valves shall be based on 2 port equal percentage valves. Select heating control valves for minimum of 25% of equipment sub-circuit pressure drop, but not more than maximum available pump head allowing minimum 2 psi drop for balancing valve. Select cooling control valves for minimum of 10% of equipment sub-circuit pressure drop, but not more than maximum available pump head allowing minimum 2 psi drop for balancing valve.
- Steam Valves:
    1. Modulating steam valves shall be straight-through globe type valves with linear characteristics for 90% of closing stroke and equal-percentage for final 10%.
    2. For steam inlet pressure less than 15 psig, the pressure drop is assumed equal to 75 to 80% of gauge inlet steam pressure.
    3. For steam inlet pressure of 15 psig or greater, pressure drop is assumed equal to 53% of absolute inlet pressure.
- Dampers shall be sized, and pressure drops obtained, from ASHRAE.
- Modulating control dampers shall be opposed blade or parallel blade type and w position (open/close) dampers shall be parallel blade type.
- Smoke dampers shall be leakage rated at no higher than Leakage Class I (4 cfm/ft2 at 1" WG and 8 cfm/ft2 at 4" WG) under UL 555S at temperature category 250 degrees F.
- Damper actuators shall be pneumatic and still have 120 VAC E-P switches to interface with Fire Protection System.

223313.16 FIRE DAMPERS

- There are no unique University Standards for this section.
- Refer to related Integrated Automation 250000 Sections.

233600 AIR TERMINAL UNITS

- The preferred variable air volume supply return/exhaust terminals for connection to single duct central air systems shall be ceiling mounted with direct acting controls on new systems and pneumatic controls on replacement systems.
- Belimo actuators are preferred.

233700 AIR OUTLETS AND INLETS

- All vents shall be dedicated vents installed at all high points and shall be goose neck, pointing straight down (drain down not up). All vent piping shall be min of 1/4" hard pipe with a 1/4" shut-off valve.
- Vents that come with all combination valves will not be considered dedicated vent and as such they will not be accepted.
- Vents in mechanical rooms shall be hard piped to a floor drain.

233713 DIFFUSERS, REGISTERS, AND GRILLES

- All diffusers, registers, and grilles shall be sized in accordance with the manufacturer's recommendations as to the face velocity, and throw. Noise levels for occupied spaces shall be based upon the recommended NC design criteria in ASHRAE.
- All diffusers and registers shall be without volume control dampers. Volume control shall be via dampers provided in the ductwork at take offs from main or branch ducts.
- University preference on suspended ceilings is 2 x 2 for supply/return diffusers and grilles.

233800 VENTILATION HOODS

- Ventilating system shall be designed per ASHRAE (latest issues) or the more stringent of the following criteria:
- Specific uses, such as radioactive materials or pathogenic organisms may need filtering and/or disinfection equipment. Check with University Safety Office.
- Discharge outlets shall be a minimum of 25 ft. away from intake or stake vents.
- Volume dampers shall be used to enable proper balancing of exhaust and supply systems. They shall be installed in all branch take-offs from main ducts and in each zone duct near unit in the case of multi-zone units. The use of splitter dampers or air scoops is prohibited. Consult SMACNA standards for proper design.

233816 FUME HOODS

- Locate hoods away from air turbulence, egress traffic, openable windows, doors, air supply grilles and heavy traffic aisles.
- Fume hoods shall be designed per ANSI/AIHA (latest issues) or the more stringent of the following criteria:
    1. Airflow velocity over the face shall be uniform within + or - 10% and are measured during normal room conditions, with a conventional exhaust system and measured at opening top, bottom, sides and center.
- Cementitious board-lined laboratory hood: The superstructure interior shall be fabricated of asbestos-free, acid-resistant, fiber-reinforced cement board at least 1/4 in. thick and manufactured for use in this application. Interior fasteners, brackets, and hinges shall be type 304 stainless steel.
- Hood performance monitoring devices or testing procedures shall be provided by the manufacturer.
- The performance monitor report or output shall be accessible to the user of the hood.
- Hood design, placement, and operation shall ensure a uniform flow of air into the hood.
- Manufacturers and suppliers of prebuilt hoods shall make available the following information regarding the manufactured hood to the Designer, User and the University's Environmental Health and Safety Office:
    1. Shall certify in writing that the fume hood is designed in accordance with the latest edition of the ANSI/AIHA Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems.
        a. The Coefficient of Entry (Ce) and/or Loss Factor for the hood under desired operating conditions.
        b. The actual volume flow rate required for optimum performance under the conditions of operation.
        c. The hood static pressure required to generate the appropriate flow.
        d. Performance test descriptions and test results that prove hood performance.
        e. Other appropriate physical parameters (e.g. damper positions, slot widths) to achieve optimum performance.

234100 PARTICULATE AIR FILTRATION

- All new installations shall be equipped with standard 24 inch by 24 inch steel frames in which are installed filters such that the face velocity does not exceed 400 feet per minute. Use stationary clips for two-stage filters.
- Special applications such as wet laboratories, clean rooms, animal care facilities, museums, materials handling and storage, and fan systems with static pressures over 3" shall require consultation with the Physical Plant and the Using Department.
- Air handling systems over 10,000 cfm shall be equipped with a two stage filter system. The final filter shall have an atmospheric dust efficiency of at least 80% or higher if required by ASHRAE. The pre-filter shall be of the expanded area type 2" deep with a high performance reinforced cotton and synthetic fabric media. The pre-filter shall be enclosed in a rigid, heavy duty high wet strength frame with diagonal support members on the entering and exiting sides of the filter. The inside periphery of the enclosing frame shall be bonded to the filter to eliminate bypass.
- All return and exhaust grilles in animal rooms shall be equipped with 2" washable area filters located in the room before the return or exhaust duct.
- Filters shall be located upstream of all coils in the air handling system.
- Differential Pressure Gauges shall be installed across each filter bank in all air handling systems. The preferred gauge shall be a Dwyer series 2000 Magnahelic differential pressure gauge with appropriate fittings or approved equal. Fans located in areas which are not readily accessible or which serve critical applications shall be equipped with a Dwyer series 3000 Photohelic gauge with adjustable high and low alarms or approved equal. All gauges shall operate from 30-80 % full scale initial to final pressure. Inclined manometer gauges are not acceptable.

235333.16 GAS FIRED HEATING UNITS

- There are no unique University Standards for this section.

235700 HEAT EXCHANGERS FOR HVAC

- High temperature hot water and high pressure steam to have tube and shell type heat exchangers with removable U-tube bundles.

236100 REFRIGERANT COMPRESSORS

- The contractor shall furnish 5 yr. Warranty. 1st year, parts and labor. 2nd thru 5th year, parts only.
- The following auxiliary equipment is required on each reciprocating system:
    1. Flexible connections at piping/compressor interface, sight glass, dehydrator, strainer ahead of each solenoid and expansion valve, suction strainer, oil separator, heat interchanger, back pressure valve, suction and discharge pressure gauges, blocking valves at compressor and at receiver (if remote from compressor), low and high pressure safety cutouts, relief valves with outlets piped to outdoors in safe location, capacity unloader, and automatic control system. Suction pressure control for compressor operation is preferred.
    2. Compressor controlled by a liquid solenoid valve to allow unit to pump down before compressor stops. Use non-recycling relay.

236200 PACKAGED COMPRESSOR AND CONDENSING UNITS

- Condensers or condensing unit systems intended for winter operation to be provided with refrigerant side low ambient controls suitable for operation at -20°F ambient temperature. Volume dampers on condenser air are not acceptable.
- Condensers with aluminum tubing are not acceptable. Use copper. Units at ground level shall be placed on concrete pads or supports and be provided with vandal resistant coil guards.
- Roof mounted units shall be placed on a minimum 18" high frame or curb to permit roof maintenance below the unit. Enclose roof curbs on all four sides when narrower than 24".
- Do not locate units under roof overhangs or gutters where damage from falling ice is possible.
- Insulation should be placed on the low suction side of all isolation valves.

236400 PACKAGED WATER CHILLERS

- Meter separately the condensate from each steam absorption refrigeration unit.
- Where more than one steam absorption unit is employed, the chilled water supply shall be connected to a common header to allow the advantage of diversity factors. Primary-Secondary piping loops are preferred.
- Condensate return from steam absorption units shall be continuously monitored with a conductivity meter to detect any contamination due to absorbent leakage. The Conductivity meter shall actuate a valve to waste all contaminated condensate. An alarm shall also be connected with an alarm signal provided to the central control system.
- Absorption refrigeration equipment to be capable of being started automatically as dictated by an outside air sensor. Provide required interconnecting wiring between the absorption machine control panel, circulating water pumps and cooling tower fans. Provide for cooling condensate from the absorption machine. Preferred method is by using cooling tower water through a heat exchanger.
- Provide for central campus automatic steam valve control.
- Steam traps to be orifice or float and thermostatic type.
- Single stage units shall have lithium bromide side inhibited from corrosion using lithium chromate. Lithium nitrate is not allowed.
- Control condenser inlet temperature between 80 to 90°F.

236500 COOLING TOWERS

- Packaged Cooling Towers:
    1. Certify cooling tower's thermal performance according to CTI 201.
    2. Electrical Components, Devices, and Accessories shall be listed and labeled as defined in NFPA 70, Article 100.
    3. The University prefers the following manufacturers:
        a. Induced-draft, cross-flow cooling towers:
            i. Baltimore Aircoil Co.
            ii. Marley Cooling Tower Co.
        b. Forced-draft, cross-flow cooling towers:
            i. Baltimore Aircoil Co.
        c. Induced-draft, counterflow cooling towers:
            i. Amcot Cooling Tower Co.
            ii. Ceramic Cooling Tower Co.; an affiliated company of Baltimore Aircoil Company.

iii. Evapco, Inc.
iv. Protec Cooling Towers, Inc.
v. Thermal Care/Mayer.

d. Forced-draft, counterflow cooling towers:
i. Baltimore Aircoil Co.
ii. Evapco, Inc.

- Cooling Towers
  1. Multiple tower units shall have common tower basins with provisions for isolation.
  2. Crossflow design is preferred.
  3. Do not locate towers in pits, inside buildings or surround with close-fitting screens that impede tower performance.
  4. Tower systems designed for winter operation shall have heated sumps.
  5. New towers shall be of packaged construction. Wood fill and construction are not acceptable.
  6. Galvanized steel cooling towers shall have an electrostatically bonded polymer coating. Bare or painted galvanized construction shall not be used.
  7. Do not mix process refrigeration with building coolant.
  8. Use variable frequency drive to control fan speed.
  9. Provide cooling towers with automatic chemical feed systems.
  10. Pitch pans minimum of 1/2" per foot to drain sump. Provide drain at bottom of sump.
  11. Provide maintenance lighting for all hot water decks.

237300 AIR HANDLING UNITS

- Chilled water drip pans are to be drainable. Evaporation pans are not allowed.

237400 PACKAGED OUTDOOR HVAC EQUIPMENT

- The Universities preference is to not install a supplemental rooftop air conditioning system unless it is required for year round cooling and the primary system is not capable of providing adequate cooling.
- Water coil capacities, pressure drops and selection procedures shall be certified to be in compliance with A.R.I. Standard 410.
- Compressors to have a five (5) year warranty.

238216 AIR COILS

- Evaporator coils assembly to be mounted in a stainless steel drain pan. Cooling coil frame to be stainless steel.
- Steam coils shall be selected with tube lengths not to exceed 6 ft. of finned copper tube with aluminum fins and shall be vertical tube with internal face and by-pass (wing) type. Special care shall be taken in sizing all steam coils where modulating control is used so as to obtain even distribution of steam under light heating loads and to prevent stratification of air temperatures. Modulating control should only be considered for coils with above freezing inlet temperatures. All modulating coils shall be provided with vacuum breaker and trap discharge legs with sufficient vertical drop to clear the coil of condensate liquid under all operating conditions.
- Steam Coils:
  1. Pipe trap 18" lower than lowest section of steam coil.
  2. Provide vacuum breaker for steam coil.
  3. Face velocity not to exceed 600 FMP.
  4. Provide each header with ½ inch vent & ¾ inch drain.
  5. Tubing requirement 5/8 OD. copper tubes with minimum 0.035' wall thickness & max 12 fpi.
  6. Casing minimum 16 gauge stainless steel. Steam coils used in systems requiring 50 to 100% outdoor air and or exposed to inlet air temperatures below 35-deg., use vertical face & by-pass arrangement only.
  7. Maintain constant steam flow through coil at outdoor air temperatures below 40 deg F.

238219 FAN COIL UNITS

- Chilled water coil frames and drain pans shall be stainless steel.

238300 RADIANT HEATING UNITS

- Baseboard radiation heating element to be 3/4" minimum ID copper tube with aluminum fins. Baseboard Enclosure to be 7" minimum height with removable front

panel.

- Cabinet unit radiation heating element to be copper (3/4" minimum) or steel (1-1/4" minimum) tubing with aluminum or steel fins. Provide enclosure with sloped top and access door. Access door to be a minimum 6" x 7", or sized to accommodate items requiring access.
- Chilled water coils shall be serpentine type with continuous circuits. Coils shall be completely drainable and vented. Coil shall be constructed of round seamless copper tubes with parallel pattern against air flow. Secondary surface shall be plate type copper or aluminum fins continuous across entire coil mechanically bonded to tubes. Casing shall be stainless steel, 16 gauge. Drain pans shall be 16 gauge stainless steel. Provisions shall be made to totally drain and air dry chilled or hot water coils. All drains and vents shall be hard piped directly to a floor drain. Control valves shall be provided at each coil.

238413 HUMIDIFIERS

- Where required, provide humidifiers of the direct steam injection type provided with steam from a local source. Injection should happen downstream of the last coil in a straight horizontal run of ductwork. Evaporative pan type or water spray humidifiers are not acceptable.

BUILDING STANDARDS

DIVISION 25 -- INTEGRATED AUTOMATION

250000 BUILDING AUTOMATION SYSTEMS

- It is the intention of the University to have automated and control systems which meet the requirements of BACnet communication according the ASHRAE standard SPC-135A/95 at every level of the device network.
- The building automation system shall be web based with the following features as minimum:
    1. System shall provide real-time navigation through the system and auto listing of all BACNet devices on the network and their objects.
    2. System shall provide view and edit operations of most objects (I/O, variables, schedules, trend) including Auto/Manual, set point, descriptions, etc.
    3. Users shall be able to view and acknowledge active alarms.
    4. Alarm notification can be e-mailed.
    5. System shall provide the same level of security as the on-site operator's terminal.
    6. System shall allow unlimited concurrent users.
- All materials and equipment used shall be standard components, regularly manufactured for this or other systems and not custom designed. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.
- All controllers performing algorithmic calculations and control of the Air Handling and other primary mechanical equipment shall have BACnet Class 3 performance as a minimum.
- Building Automation Systems (BAS) performance requirements shall include the following applications:
    1. Heating, Ventilating and Air Conditioning Monitoring, Equipment and Lighting Control
    2. Energy Management Routines
    3. Future Fire Alarm connectivity through existing BAS
    4. Miscellaneous Equipment Monitoring
- A trunk cable riser diagram showing Digital System Controllers/Security Digital System Controllers/Fire Digital System controllers (DSC/SDSC/FDSC) locations, and all trunk data conductors shall be furnished.
- All BACnet devices shall include all hardware and software necessary to integrate the controls with the existing BACnet over Ethernet or IP network and meet the systems functional specification.
- Any BACnet device that exists on a common BACnet inter-network must have a unique address, referred to as its Device Instance. The Chief Plant Operating Engineers Office shall establish the Device Instance numbering system.
- The BAS shall be a computer based distribution system that shall monitor life safety, mechanical and electrical equipment status and have the capability of controlling certain mechanical, electrical and life safety system components. The architecture of the system shall be a distributed one in which the monitor/control function responsibility is located as close as possible to the monitored/controlled variable. This results in several levels of processing which can stand alone should the communication be lost to the next higher level of processing.
- The Mechanical Equipment Controller shall be connected to the system through the local network to the system backbone, for each piece of mechanical equipment, and provide all BACnet System defined functionality. The operator has direct access to all network devices at this point of entry.
- Equipment Control will be provided by programmable or application specific Controllers. All algorithms required for standalone operation of each control loop will be contained within the unique board. The controlled equipment will maintain its set points and logic regardless of centralized network communications.
- The Central Computer will provide the operator with a point of entry to view and store the data that is required for efficient system operation.
- Provisions shall be made to provide hub locations that allow for future interface of the Fire Alarm and Life Safety equipment. These hubs will be connected to the primary system backbone.
- The Fire Digital System Controller (FDSC) shall be a device which shall monitor and control life safety devices directly connected to it.
- BAS shall monitor/control all the points and functions as listed below.
    1. Inputs monitored or alarmed and output control functions.
    2. Digital input indication signals from contacts associated with on-off, off-normal, normal or other indications initiated by making or breaking of the contacts.

3. Digital output signals which shall be two state control outputs, except as noted, e.g., on-off, open-close, start/stop. Momentary or a maintained state shall be noted as required.
4. Analog I/O signals which are continuously variable.
5. The schedule shall include calculations from software of functions monitored, e.g., BTU, kilowatts, etc., if requested by the University.
6. The schedule shall include totalization of variables within the software. This shall include totalization program requirements for on-line assignments.

- The system shall be modular to allow change of function and operation in the field by plug-in module equipment and permit software change to expand the system capacity on full on-line basis.
- The system shall include isolation, shielding, or filtering to eliminate interference from all external sources including, but not limited to radio signals, power conductors, etc.
- Networking:
  1. Each control unit shall be capable of sharing point information with other such units, such that control sequences or control loops executed at one control unit may receive input signals from sensors connected to other units within the network. If the network communication link fails or the originating control unit malfunctions, the control loop shall continue to function using the last value received from the failed control unit.
  2. Failure of one control unit shall have no other effect upon any of the other units in the network.
- The following is a list of manufacturers of materials and equipment that are known to have product that is Native BACnet at all levels of device communications. Only these manufacturers are considered acceptable. Manufacturers advocating gateways at different levels of their product line are not acceptable. Gateways and alternative methods of network communication are only considered acceptable when provided by the manufacturer of primary plant systems such as Variable Frequency Drives, Boilers, Packed Rooftop Equipment, Chillers, etc.

MATERIAL OR EQUIPMENT	**MANUFACTURER**
Native BACnet Temperature Control Systems	Alerton Technologies, Delta Control Products, Automated Logic

- Each Control Panel shall be capable of independently performing the following routines as a minimum:
  1. System graphic
  2. System on/off indication
  3. System day/night mode
  4. Supply fan on/off indication
  5. Return fan on/off indication
  6. Heating coil pump on/off indication
  7. Outside air temperature indication
  8. Mixed air temperature indication
  9. Fan discharge air temperature indication
  10. Fan discharge temperature control point adjustment
  11. Supply static pressure indication
  12. Supply static pressure control point adjustment
  13. Humidity sensor
  14. Enthalpy sensor
  15. System on/off auto switch position.
  16. System day/night/auto switch position.
  17. Supply fan on/off switch position.
  18. Return fan on/off/auto switch position.
  19. Heating coil pump on/off switch position.
  20. Time of day scheduling.
  21. Start/stop time optimization.
  22. Peak demand limiting.
  23. Duty cycling (temperature and/or time based).
  24. Enthalpy optimization.
  25. Supply air reset.
  26. Chilled water reset.
  27. Hot water reset based on outdoor air temperature.
  28. Event initiated programs.
  29. Trending.

- The Control Panel shall support the creation, modification or removal of control algorithms while operating. The DSC shall be programmed using a sequential, numbered-statement programming language.
- The Control Panel shall allow custom control algorithms to be created:
    1. Locally within the Control Panel.
    2. Centrally within the front end computer and downloaded.
    3. By a personal computer (IBM compatible) and downloaded.
- Front End Computer System.
    1. The software shall include a real-time multi-user operating system.
    2. Operator Interface with the system will have as a minimum the following:
        a. Operator access
        b. User control over system configuration
        c. Facility management functions
        d. Energy management control functions
    3. Each category of software shall consist of interactive software modules utilizing standard software packages available on the open market and not proprietary to any one equipment provider. Each module shall have an associated priority level and shall execute as determined by the program controller as defined in the real-time operating system.
    4. The Software shall use English language for each point identification. These shall be full English words with the option to abbreviate at the user's discretion. The system shall accept multiple English language identifiers as well as foreign language identifiers for each point on the system. These shall be known as "User Names". In addition, system formatting shall be provided which shall allow for software grouping of related points.
    5. The system shall operate on a Format basis, regardless of the manner of hardware configuration in which data is acquired. A system of points shall consist of a logical grouping of data points related to a piece of mechanical equipment, and energy distribution system, or an architectural area. For example, in some cases it may be desired to display a space temperature with its associated air handling unit, and in other cases to display all space temperatures on a floor or in a building as a single system.
    6. The Software shall allow such determinations to be made without regard to physical hardware location(s). Likewise, the system shall accommodate future changes of system grouping and operations without field hardware changes.
    7. User names, point descriptors, and engineering units shall be operator definable on a per point basis. Systems which use fixed vendor-supplied look-up tables are not be acceptable.
- User Control Over Configuration:
    1. The intent of this standard is to provide a system which shall allow the University to independently do its own modifications to the system.
    2. All changes shall be done utilizing standard procedures and must be capable of being done while the system is on-line and operational. To aid an operator, intuitive operator interfaces shall be employed. The operator shall be required to simply click on the set-point, logical point or other controlled parameter to modify the system.
    3. The system shall have the minimum capability to allow the University to do the following:
        a. Add and delete points.
        b. Modify any point parameter.
        c. Change, add or delete English language descriptors.
        d. Change, add or delete engineering units.
        e. Change, add or delete points in start/stop programs, trend logs, etc.
        f. Select analog alarm limits.
        g. Adjust analog differentials.
        h. Create custom relationships between points.
    4. The BAS software shall support an unlimited number of nodes on the communication network.
    5. Once the hardware terminal devices are installed, the operator shall be able to modify the system software to accommodate the new or reconfigured devices.
    6. It shall be possible to limit the capabilities of any console on the system.
    7. It shall be possible to further assign on a per point basis the ability to command, display or alarm a point at a specific workstation.
- Provision for facilities management functions shall be provided as a minimum.
- Provision for Energy Management Control Functions shall be provided as a minimum for the purpose of optimizing energy consumption while maintaining occupant comfort.
- Communication Software:
    1. The system shall include a software for communication between all systems. The capabilities of this software shall include program to program

communication, network virtual terminal capability, file transfer, remote command/batch file submission and execution, remote resource access, downline system loading, downline task loading, and upline dumping.

2. The software shall be consistent with ASHRAE Standard 135 and support the required BACnet system functionality as defined in the Standard.

- Digital Systems Controller (DSC):
  1. The units shall maintain the programming and algorithms necessary to control independent mechanical systems. The Digital System Controller shall communicate over a local LAN connected to the System LAN at the individual control panels.
  2. These units shall connect directly to control unit through a local area network, providing additional local digital point capacity. All control programs shall reside within the associated control unit.
  3. Digital System Network (DSN):
     a. Network Controllers shall be stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules.
     b. Each Controller shall have sufficient memory to support its own operating system and databases, including:
        i. BAS Control processes
        ii. Energy management applications
        iii. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
        iv. Historical/trend data for points specified
        v. Maintenance support applications
        vi. Custom processes
        vii. Operator I/O
        viii. Dial-up communications
     c. Each DDC Controller shall support any combination of industry standard inputs and outputs.
     d. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
        i. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
     e. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Status indication shall be visible without opening the panel door.
     f. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
     g. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980, or latest edition.
     h. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
        i. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
        ii. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local port, via telephone line dial-in or from a network workstation PC.
- Data Trunk:
  1. Transmission Network:
     a. The system shall use an intelligent distributed communication network.
     b. Transmission
        i. Network communications shall be of the ASHRAE 135 Standard
- Definitions: The following abbreviations, acronyms and definitions are used in addition to those details found elsewhere in Contract Documents.

Actuator:	Control device to provide motion of valve or damper in response to control signal.
AI:	Analog Input
AO:	Analog Output
Analog:	Continuously variable state over stated range of values
ATC:	Automatic Temperature Control
Auto-Tune:	Software routine used to adjust tuning parameters based on historical data.
BAS:	Building Automation System
BCU:	Building Control Unit
CAV:	Constant Air Volume
CGS:	Color Graphic Software
DDC:	Direct Digital Control
DDCP:	Direct Digital Control Panel
Discrete:	Binary or digital state
DI:	Discrete Input
DO:	Discrete Output
EMCS:	Energy Management and Control System (Same as BAS)
FC:	Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
FMS:	Facility Management System linking two or more BAS
FO:	Fail Open position of control device or actuator. Device moves to open position on loss of control signal or energy source.
HCP:	Host Control Panel
I/P:	Current to pneumatic transducer
Instrument:	Device used for sensing input parameters or used for actuation
LAN:	Local Area Network
LCD:	Liquid Crystal Display
LCP:	Local Control Processor
Modulating:	Movement of a control device through an entire range of values proportional to infinitely variable input values.
Motorized:	Control device with actuator.
NC:	Normally Closed position of switch after control signal is removed or normally closed position of manually operated valves or dampers.
NCP:	Network Control Processor
NO:	Normally Open position of switch after control signal is removed or normally open position of manually operated valves or dampers.
Node:	DDCP, user workstation, or other control device connected to communication's network.
Operator:	Same as actuator.
PC:	Personal Computer
Peer-to-Peer:	Mode of communication between controllers in which each device connected to network has equal status and each shares its database values with all other devices connected to network.
P:	Proportional control, control mode with continuous linear relationship between observed input signal and final controlled output element.
PHP:	Public Host Protocol
PI:	Proportional - Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controlled variable (Reset control).
PID:	Proportional - Integral - Derivative control, control mode with continuous correction of final controlled output element versus input signal based on proportional error, its time history (reset), and rate at which its changing (derivative).
Point:	Analog or discrete instrument with addressable database value.
PUC:	Programmable Unitary Controller
PUP:	Public Unitary Protocol
RAM:	Random Access Memory
RCU:	Remote Control Unit

Self-Tune:	Same as Auto-Tune
Solenoid:	Electric two-position actuator.
TCC:	Temperature Control Contractor (Same as Control Contractor)
TCP:	Temperature Control Panel
VAV:	Variable Air Volume

- The HVAC temperature control hardware will be native BACnet. Native BACnet means that the database objects in the controller can be seen by other BACnet systems, and data can be exchanged between other BACnet devices without the need for a gateway.
- The primary building local area network (LAN) will be based upon the ISO 8802-3 ethernet standard. Under no circumstances will the customer's building LAN be subject to failure and/or abuse. All BACnet devices that reside on the LAN must support the BACnet broadcast management device (BBMD) scheme. Global broadcasting will not be permitted without the use of a BBMD.
- The primary campus wide area network (WAN) is the internet at the University of Illinois at Chicago. The BACnet system will be capable of internet protocol (IP) communications to the main control panel, the application specific controllers and down to the room thermostat. BACnet/IP or Annex J will be considered the basis of design.
- The University of Illinois at Chicago main platform is ORCA View. ORCA View communicates over UDP/IP to view BACnet objects and devices. Internet protocol (IP) addresses (IP numbers) will be assigned to the main BACnet HVAC control panel in the building, assigning its place on the University's internet backbone communication system.
- Internet Protocol Address (IP) will be assigned by the University at the building location.
- All Building Automation Systems must provide for remote communications to the Central Operations Office of the Operating Engineer on both the East and West Campuses.
- Acceptable Control Contractors:
    1. Delta Controls
    2. Alerton Technologies
    3. Automated Logic
- Systems Description:
    1. System shall be pneumatic, electric or electronic.
    2. Control system shall be direct digital control (DDC).
    3. Damper and valve actuators for major equipment in mechanical rooms shall be pneumatic. Actuators for remote devices located in spaces outside of mechanical rooms shall be electronic type.
    4. Control to be based on BAS architecture consisting of communication network, user workstations, modular designed DDCPs with all points addressable and modifiable from user workstations or from master DDCP user interface panels. BAS shall be fully stand-alone and shall communicate via BACnet/Ethernet/Internet communications protocol. System components shall be fully BACnet/Ethernet/Internet compliant without the use of gateways. System must be able to communicate with the main platform (Orcaview) at the University of Illinois at Chicago via Protocol Address (IP) will be assigned by the University at the building location.
    5. System shall support user workstations as specified and shall be capable of additional workstations, limited only by systems maximum node capacity.
    6. System intelligence shall be such that user workstation(s) can be used for programming controls, performing analysis on filed data, perform trending of user defined inputs, generating maintenance and operation reports, providing permanent storage for programs and data, and the ability to connect to the Internet.
    7. Safety devices shall function in both auto and hand modes on starter.
- Recommended instrument and control conductor color code shall be as follows:

Type	**Color**
120 VAC control signal	Red

120 VAC instrument line power	Black
120 VAC instrument line neutral	White
24 VAC control signal	Yellow
24 VAC instrument line power	Brown
24 VAC instrument line neutral	Orange
Grounds	Green
24 + VDC instrument signal	Black
24 - VDC instrument signal	White or clear
RTD V+	Black
RTD V-	White
RTD compensation	Red

- Electric signal cables from electronic transmitters to receivers and from controllers to final control elements shall be continuously shielded. Shields shall be grounded at power source end only and floated at the other end.
- BAS Network Communication Cable:
    1. BAS network communication cable shall not be spliced.

251100 INTEGRATED AUTOMATION NETWORK DEVICES

- All newly installed BACnet devices shall be installed on two non-firewalled network segments, one for each campus, reserved solely for these devices. No NAT firewalls are to be used on this network. Additional network segments may be added in the future as needed.
- Integrating devices from multiple vendors requires careful administration of various configuration and management data. Critical vendor device configuration information includes:
    1. IP number
        a. IP delegation, routing and switch management are maintained by the Academic Computing and Communications Center (ACCC). IP numbers shall be assigned and registered in the UIC DNS by the Physical Plant REACH representative (currently Gershon Marmel as of 08/30/2006)
    2. Device Instance number
        a. Device instance numbers are BACnet native identifiers. Instance numbers must be confirmed with the Physical Plant REACH representative prior to device installation and must be registered in the UIC BACnet database upon registration of the IP number used for said device. UIC Instance numbers shall conform to the following format:
        XXXYYYY
        where: XXX = UIC building number
        YYYY = unique numeric identifier within the designated building.
        The resulting numeric string constitutes a campus-wide unique identifier, in order to prevent network device conflicts.
    3. Virtual Network Number

a. Virtual network numbers are BACnet designators which segregate BACnet traffic between different vendor devices. Virtual network numbers must be confirmed with the Physical Plant REACH representative prior to device installation and must be registered in the UIC BACnet database upon registration of the IP number used for said device. Each vendor will have sole use of delegated numbers, to prevent network segment conflicts.

4. UIC BACnet Database Storage
   a. The UIC BACnet database tables store all necessary information critical to the administration of network configuration and management data. ACCC shall maintain these tables and provide a web-based interface to insert, update, and retrieve all BACnet data. All IP numbers used must be registered in the UIC DNS as well as the UIC BACnet database tables. Table information includes:
      i. IP number
      ii. Device Instance number
      iii. Virtual Network number
      iv. Vendor name
      v. Device type (Server, BBMD, OWS, etc.)
      vi. Building number
      vii. Room number
      viii. update id (auto-generated netid of person who updated field)
      ix. timestamp (auto-generated upon database insertion/update)

251300 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORKS

- Direct Digital Control Panels (DDCP's) shall be microprocessor based, field programmable controllers, capable of performing control and energy management functions, and shall be UL listed as Signaling Systems. Each DDCP shall include its own microprocessor, power supply, input/output modules, and termination modules as required to perform its intended function.
- DDCP shall receive discrete electrical or analog electronic field input signals, convert signals for use by controller, perform control sequences, convert controller information into output signals, and provide control output signals to actuators and field control device. All inputs and outputs, including communication connections, shall be electrically or optically isolated from controller.
- DDCP with analog input modules shall be capable of accepting any form of linear or non-linear voltage (0-5 VDC or 0-10 VDC), current (4-20 mA) or resistive input (0-1000 ohm).
- DDCP with discrete input modules shall be capable of accepting discrete inputs from any device with isolated, dry-type contacts (no grounds or no voltage) of either normally open (NO) or normally closed (NC) configuration.
- Input modules shall be capable of interfacing with pulsed output type sensors.
- DDCP shall have capability to scale, offset, and display proper analog value without field hardware modification. DDCP shall convert analog input signals to digital values (A/D conversion) and convert digital values to analog outputs (D/A conversion) for modulating control purposes.
- Failsafe operation shall be provided such that BAS failures result in immediate return to local control. If the DDCP uses database values from other DDCP and the communication network fails or malfunctions, control loop outputs shall continue to function using last value received from BAS.
- DDCP shall have ability to interface and communicate with Host Control Panel (HCP) through a dedicated network. DDCP shall be fully operable from and have all points and functions available to centrally alarm at any DDCP or PC workstation connected to a BAS network.
- Three types of DDCP's are allowed, Building Control Units (BCU's), Remote Control Units (RCU's), and Application Specific Controllers (ASC's).
- BCU's are defined as having capabilities of direct connection to high speed Local Area Network (LAN) (greater than 500 kilobaud), serve as communications hub for other BCU's on slower speed LAN, and have sufficient processor capabilities and RAM to implement all types of custom software applications. BCU's shall have serial type input/output (I/O) ports to directly support operator workstations (portable PCs), standard ASCII dumb terminals, modems, and all types of printers.
- BCU's shall have uninterrupted real time clocks capable of time of day, week, and year information to the system as needed to perform software functions. Clock shall be programmed to reset twice a year to allow for Daylight Savings Time. Clocks in multiple BCU's shall be synchronized automatically to match designated BCU or workstation. Accuracy shall be within 1 second per day minimum.
- BCU batteries shall maintain all volatile memory and real time clocks for a period of at least 72 hours during power failure. Batteries shall be maintenance free and have

minimum life of 2 years. When power has been restored, the following shall occur automatically:

1. Orderly startup of all controlled equipment (user defined).
2. Continuation of all control algorithms.
3. Data base revision.
4. Log times of power interruption and restoration.
5. Battery recharging.

- RCU's are defined as being the same as BCU's but without high-speed LAN capabilities or I/O ports. RCU's shall communicate with BCU's and other RCU's via low/medium speed network or direct serial or parallel data bus interface.
- ASC's are defined as having standard software burned into EPROM, set points in EEPROM or RAM maintained by battery, and are designed to handle specific types of control sequences. ASC's shall be capable of communicating to BAS network via low/medium speed network connected to BCU's.
- All software and hardware to be covered by site license for a minimum of 30 users. Adding to or modification of the basic system should not require additional licenses.
- BCU/RCU Software shall contain:
    1. Program modules for performing energy management control functions such as time of day change of database values (programmed start/stop, temperature setbacks, etc.), supply air temperature reset based on space load demand, economizer control, optimum start/stop based on current indoor and outdoor psychometrics, duty cycling and client tailored programs required for special applications such as VAV fan matching and supply fan control, enthalpy control, intermediate season or "dead band" control, totalizing, and holiday programming.
    2. Manufacturer's standard operating system for real time control of system interactions, including database information requests/transfers by system hardware or by operators. Operating system shall also have the following additional capabilities (given operator has appropriate security access level):
        a. Display any database (point) value including measured values, controlled variables, set points, gain factors, and any other adjustable parameter.
        b. Change or override any database value.
        c. Error detection, correction, re-transmission of database values, arithmetic or logical faults.
        d. Alarm reporting including sending alarms to remote workstations on network or by modem.
        e. Alarm buffer to retain all alarms in order of importance without losing any alarms.
        f. Creating and displaying historical trend logging any value limited only by available memory.
        g. Create new variable database values (soft points) based on arithmetic calculation (including summation or totalizing) on other database values.
        h. Add new hardware points without overall BAS shutdown.
- All hardware/software to update database in less than 1 second for fast-acting control loops such as pressure control, air or water volume control, and air handling unit temperature control, or 10 seconds or less for all other control loops.
- Graphics to be generated shall include, but not be limited to:
    1. Site Plans, including each building, building name, and status of all exterior points such as lighting, etc.
    2. Overall building plan of each building. Indicate location of mechanical rooms and areas served by each air handling unit.
    3. Voltage and current values shall be displayed for all motors 50 HP and above. Each shall be displayed next to the motor graphic on the display screens.
    4. Schematic type graphics for:
        a. Each air handling system
        b. Supply fan control loop
        c. Cooling coil control loop
        d. Heating coil control loop
        e. Humidifier control loop
        f. Damper control loops
        g. Steam system showing all components
        h. Each hot water system showing all components.

253000 INTEGRATED AUTOMATION INSTRUMENTATION AND TERMINAL DEVICES

- Accuracy of devices shall be ± 1% of scale with adjustable offset unless otherwise specified.
- Wall mounted space thermostat enclosure shall have concealed sensing element and

exposed set point adjustment.
- Unless otherwise stated, space thermostat covers shall be brushed aluminum or brushed nickel.
- Temperature Low Limit Switches (Freezestats):
    1. Electric 2 position type with temperature sensing element and manual reset. Controls shall be capable of opening circuit if any one foot length of sensing element is subject to temperature below setting.
    2. Sensing element shall not be less than one lineal foot per square foot of coil surface areas. Temperature switch set point is 38°F.
    3. Where multiple switches are required, each switch shall have a separate point names in the BAS. Each alarm in BAS shall indicate which temperature low limit has opened or tripped.
- Pressure Differential Switches (Air Systems):
    1. Pressure differential switches for air systems shall have pressure rating of at least 1-1/2 times the systems pressure.
- Pressure Differential Switches (Water Systems):
    1. Pressure differential switches for water systems shall be rated for 1-1/2 times system pressure. Chilled water pressure differential switches shall be provided with totally sealed vapor tight switch enclosure. Differential pressure switches to have 3-valve manifold for servicing.
- Level Switches (Ultrasonic Gap Sensor):
    1. Radio Frequency (RF) type point level probe with stainless steel probe and DPDT snap action relay contacts to meet intended use. Probe shall have a machined gap in the probe to sense presence or absence of water or other fluid. Probe length shall be determined by application.
- Analog Electronic Instrumentation: The following shall be standard off-the-shelf, commercially available and applicable for use with electronic control/monitoring systems.
    1. Space Temperature Sensors
    2. Duct Mounted, Insertion or outside Temperature Sensors
    3. Direct Insertion Temperature Sensors
    4. RTD Temperature Transmitters
    5. Space Humidity Sensors/Transmitters
    6. Duct Mounted Humidity Sensors/Transmitters
    7. Ducted Air System Static Pressure and Differential Pressure (Velocity) Transmitters
    8. Pressure/Differential Pressure Transmitter
    9. Vortex Flowmeter/Transmitter (Steam)
    10. Capacitance Type Level Transmitter
    11. Pressure (E-P) Transducers
    12. Carbon Monoxide Monitor

253516 INTEGRATED AUTOMATION SENSORS AND CONTROLS

- Control Instruments
- Thermostat
- Temperature Sensors
- Valves / Actuators
- Dampers / Actuators
- Humidity Sensors
- Control Panels / Transformers and Wiring
- Electronic Building Network Controllers
- Networked Modular I/O and Unitary Controllers
- Local and Remote Browser / Operator Work Station
- Building Site Server / Firewall Description
- Hardware
- BAW/OWS Issues
- Water Flow Meters (Magnetic)
- Differential Pressure Transmitter (Liquid)
- Gas Meter
- Demand Control CO2
- Air Flow Measuring
- Gas Monitoring
- Lighting Control
- Security Control
- Miscellaneous Control Equipment Wiring
- Programming/Graphics
- Programming will combine the simplicity of graphical programming with the precision and efficiency of line-oriented Java script programming. It must deliver a library of math, logic and control blocks that the programmer can drag and drop

onto the screen to graphically model the control strategy for a piece of HVAC equipment.These control strategies must provide excellent sequence documentation and are reusable, eliminating the need to recreate them for every project.

- NOTE: The BAS system must have:
  1. a built-in web server and internet interface.
  2. XML formatted data over HTTP.
  3. ASHRAE BACnet/IP protocol over Ethernet.
  4. Microsoft Windows XP or 2000 Professional Operating Systems compatibility.
  5. IT-friendly connectivity, firewall compatible.
- The successful bidder shall provide graphs of trend logs of all points specified by the A/E on the point list for every project. It is the intention of the University to have trend logs periodically (i.e., every 15 minutes). The successful bidder shall prove to the university through the trend logs that all devices are working properly and smoothly (i.e., no hunting of valves or dampers will be allowed).
- The BAS contractor will display all dynamic color graphics as required by owner.
  1. All color graphic floor plan (project's CADD/Auto CAD drawings transported) displays and system schematics for each piece of mechanical equipment, including air-handling units, chilled water systems and hot water systems will be provided to optimize the system performance analysis and speed alarm recognition. The sequence of control for each piece of mechanical equipment shown on a graphic must also be included as an overplay on that screen. This will allow the operator to review the sequence of control on the graphical screen pertaining to mechanical equipment shown. All software engineering required to construct the graphics to be included under this contract.
  2. System operator security/penetration: The system operator's security clearance level will allow the user to access the various system schematics and floor plans, based upon the owner's appointed security level given to that user.
  3. Dynamic data displays: Dynamic temperature valves, humidity valves, flow valves and status conditions shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.
  4. Graphics' colors pertaining to on/off status will be "green" for on and "red" for off conditions.
  5. Dynamic objects shall include analog and binary values, dynamic text and static text.
- Basic design considerations for building temperature control include the following:
  1. The use of hydronic heating is preferred.
  2. Direct radiation in rooms should be provided with wall thermostatic control.
  3. Room thermostats shall control all heating and cooling in the room.
  4. A diagram of the temperature control system and a sequence of operations prepared by the Contractor and mounted under glass shall be installed in the mechanical equipment room for each project.
  5. All HVAC air-handling units must be provided with a manually adjustable freezestats.
  6. Winter-summer changeover switches and damper control switches must have manual override provisions incorporated in the temperature control systems.
  7. Provide a high limit humidistat in systems with humidifiers.
  8. When cooling is introduced in the system, it is preferred (if reciprocating type compressors are used) that the compressor operates on suction pressure control to give approximately constant suction temperature, and a relatively constant apparatus dew point. A solenoid valve in the liquid line at the expansion valve, operated by room or return air humidistat can be used, and together with the reheat coils and controls maintain predetermined room temperature and humidity.
- Automatic Dampers
  1. Each damper section shall have an individual operator. No linkages shall be installed between dampers to transfer operator power. Manufacturer's catalog information shall be de-rated 50% for application to provide positioning of the dampers. Damper operators shall not be of the swing mounting type. They should be mounted outside the air stream where possible, especially in outside air applications. Pneumatic control lines, where they penetrate outside air ducts, shall include dehydrator units. Outside air and return or relief dampers that are automatically controlled shall be of the minimum leakage type. Quality of dampers shall be specified, including air leakage at 3/4 inch static pressure when the damper is in the closed position. Provide neoprene edges and tips on blades.
- Electronic Control valves and Dampers
  1. All control valves and dampers shall be electronic modulating.
  2. **They shall all be "proportional" and shall provide feedback to the BAS.**

255500 INTEGRATED AUTOMATION CONTROL OF HVAC

- Provide a Sequence of Operations for new building Systems as approved by the User.
- Provide Central HVAC Systems Display as applicable:
    1. System graphic
    2. System on/off indication
    3. System day/night mode
    4. Supply fan on/off indication
    5. Return fan on/off indication
    6. Heating coil pump on/off indication
    7. Outside air temperature indication
    8. Mixed air temperature indication
    9. Fan discharge air temperature indication
    10. Fan discharge temperature control point adjustment
    11. Supply static pressure indication
    12. Supply static pressure control point adjustment
    13. Humidity sensor
    14. Enthalpy sensor
    15. System on/off auto switch position.
    16. System day/night/auto switch position
    17. Supply fan on/off switch position.
    18. Return fan on/off/auto switch position.
    19. Heating coil pump on/off switch position.

BUILDING STANDARDS

DIVISION 26 -- ELECTRICAL

260126 MAINTENANCE TESTING OF ELECTRICAL SYSTEMS

- Low voltage testing (600V and less):
  1. After wires and cables are in place and connected to devices and equipment, the system shall be tested for short circuits, improper grounds, and other faults. When fault condition is present, the trouble shall be rectified, then re-tested.
  2. Voltage test shall be made at each lighting and distribution panel. When potential is not within 2 percent of rated voltage, the condition shall be corrected by tap changes or power company correction of line voltage.
  3. All wiring devices and electrical apparatus furnished under this contract, when grounded or shorted on any integral "live" part, shall be removed and the trouble rectified by replacing all defective parts and materials.
  4. All service and feeder cables, after being pulled in place and before being connected, shall have a Megger test conducted to determine that wire and cable insulation resistance is not less than that recommended by the National Electrical Code. Copies of all tests shall be given to the Architect/Engineer. All cables failing insulation test shall be removed, replaced, and re-tested.
  5. All motors shall be tested under load with ammeter readings taken for each phase, and the rpm of motors recorded at the time. All motors shall be tested for correct direction of rotation. Run tests on all motors and verify that proper overload devices have been installed. The following shall be submitted for approval by the Architect/Engineer:
     a. Test and record the following on all motors:
        i. Fuse size
        ii. Heater size
        iii. Full load amp
        iv. Running amp
        v. Rated voltage
        vi. Terminal operating voltage
        vii. Two (2) copies of all test data shall be delivered to the Using Agency and Architect/Engineer.
- High Voltage Testing (greater than 600V):
  1. On all new installations, cables are to be tested per IEEE Standard 400-1980. Maximum test voltages shall be in accordance with Table 1 of IEEE Standard 400-1980.
  2. When new cable is spliced to existing cables or tests are done on existing cables; a Facilities Management Electrical Engineer shall be present and approve voltage levels for the High-Direct-Voltage (Hi-pot) test. IEEE Standard 4001980 is to be used as a guideline except for the test voltage levels.
  3. Cables above 600 volt and all associated terminations and splices installed shall be field tested in the presence of the Architect/Engineer and Facilities Maintenance personnel before being energized. All tests shall be in accordance with and under the direct supervision of an authorized, qualified representative of a certified testing company.
  4. The maximum test potential shall be manufacturer recommended KVDC for new cables only. Facilities Maintenance shall specify the voltage for tests that involve existing high voltage cables. Test potentials shall be applied for 10 minutes. Allow 1 minute for voltage stabilization. Take 10 step readings at 2.5 kV increments. The following information shall be recorded:
     a. The amount of leakage current in micro-amps or milliamps at full test voltage after 10 minutes.
     b. The discharge time down to 7 KVDC between each phase conductor and ground.
     c. The voltage after one (1) minute discharge beginning immediately after each test.
  5. In addition to the above recorded information, proper Graphs shall be plotted to show the following relationships:
     a. Leakage current in micro-amps versus time in minutes.
     b. Leakage current in micro-amps versus applied potential (KVDC).
  6. Care shall be taken to properly identify the phase conductors tested in all test recordings and graph plottings.
  7. If during the field acceptance testing a high resistance fault or low resistance fault in the cable, splice, termination, etc., is apparent, the fault shall be cleared, necessary repairs made, and the cable re-tested in accordance with this specification.
  8. If the acceptance test indicates a cable with possible moisture penetration, locate the cable affected, remove same, and install new cable that is free from moisture.
  9. If after proper testing of the cable the independent testing representative and/or the Architect/Engineer do not approve the cable, the cable that is not approved shall be removed and a new cable installed. All cables must be tested and approved by the Architect/Engineer before final acceptance. Supply

all additional cable that is required.

10. Three (3) copies of all acceptance test recordings and graphs shall be submitted to the Architect/Engineer before final acceptance of the distribution system will be authorized.

- Ground Testing:
  1. TEST: The resistance between ground grid and absolute earth shall not exceed 25 ohms and shall be measured in the presence of the Architect/Engineer before equipment is placed in operation.
- Fire alarm detection system:
  See Section 283100 (Fire Detection and Alarm) for Fire Alarm acceptance testing.

TABLE 10.6
Medium Voltage Cables
Maximum Field Acceptance Test Voltages (kV, dc)

Insulation Type	Rated Cable Voltage	Insulation Level	Test Voltage kV, dc
Elastomeric:			
Butyl and Oil Base	5 kV	100%	25
	5 kV	133%	25
	15 kV	100%	55
	15 kV	133%	65
	25 kV	100%	80
Elastomeric:			
EPR	5 kV	100%	25
	5 kV	133%	25
	8 kV	100%	35
	15 kV	133%	45
	15 kV	100%	55
	15 kV	133%	65
	25 kV	100%	80
	25 kV	133%	100
	28 kV	100%	85
	35 kV	100%	100
Polyethylene	5 kV	100%	25
	5 kV	133%	25
	8 kV	100%	35
	8 kV	133%	45
	15 kV	100%	55
	15 kV	133%	65
	25 kV	100%	80
	25 kV	133%	100
	35 kV	100%	100

Derived from ANSI/IEEE Standard 141-1993 Table 12-9 and by factoring the applicable ICEA/NEMA Standards.
NOTE: AEIC CS5 and CS6, and ANSI/IEEE Standard 400 do not differentiate cables based upon insulation thickness and, consequently, list differing test voltages.

- Inspection and Test Procedures
  1. Medium-Voltage, 69 kV Maximum:
     a. Visual and Mechanical Inspection:
        i. Compare cable data with drawings and specifications.
        ii. Inspect exposed sections of cables for physical damage.
        iii. Verify tightness of accessible bolted connections by calibrated torque wrench in accordance with manufacturer's published data or Table 10.12. Perform thermographic survey in accordance with Section 9.
        iv. Inspect compression-applied connectors for correct cable match and indention.
        v. Inspect for shield grounding, cable support, and termination.
        vi. Verify that visible cable bends meet or exceed ICEA and/or manufacturer's minimum allowable bending radius.
        vii. Inspect for adequate fireproofing in common cable areas, if specified.
        viii. If cables are terminated through window-type current transformers, make an inspection to verify that neutral and ground conductors are correctly placed and that shields are correctly terminated for operation of protective devices.
        ix. Visually inspect jacket and insulation condition.

x. Inspect for correct identification and arrangements.

b. Electrical Tests:

i. Perform a shield-continuity test on each power cable by ohmmeter method.

ii. Perform an insulation-resistance test utilizing a megohmmeter with a voltage output of at least 2500 volts. Individually test each conductor with all other conductors and shields grounded. Test duration shall be one minute.

iii. Perform a dc high-potential test on all cables. Adhere to all precautions and limits as specified in the applicable NEMA/ICEA Standard for the specific cable. Perform tests in accordance with ANSI/IEEE Standard 400. Test procedure shall be as follows, and the results for each cable test shall be recorded as specified herein. Test voltages shall not exceed 80 percent of cable manufacturer's factory test value or the maximum test voltage in Table 10.6.

a. Insure that the input voltage to the test set is regulated.

b. Current-sensing circuits in test equipment shall measure only the leakage current associated with the cable under test and shall not include internal leakage of the test equipment.

c. Record wet- and dry-bulb temperatures or relative humidity and temperature.

d. Test each section of cable individually.

e. Individually test each conductor with all other conductors grounded. Ground all shields.

f. Terminations shall be adequately corona-suppressed by guard ring, field reduction sphere, or other suitable methods as necessary.

g. Insure that the maximum test voltage does not exceed the limits for terminators specified in IEEE Standard 48 or manufacturer's specifications.

h. Apply a dc high-potential test in at least five equal increments until maximum test voltage is reached. No increment shall exceed the voltage rating of the cable. Record dc leakage current at each step after a constant stabilization time consistent with system charging current.

i. Raise the conductor to the specified maximum test voltage and hold for 15 minutes on shielded cable and five minutes on non-shielded cable. Record readings of leakage current at 30 seconds and one minute and at one-minute intervals thereafter.

j. Reduce the conductor test potential to zero and measure residual voltage at discrete intervals.

k. Apply grounds for a time period adequate to drain all insulation-stored charge.

l. When new cables are spliced into existing cables, the dc high-potential test shall be performed on the new cable prior to splicing in accordance with Section 7.3.2. After test results are approved for new cable and the splice is completed, an insulation-resistance test and a shield-continuity test shall be performed on the length of new and existing cable including the splice. After a satisfactory insulation-resistance test, a dc high-potential test shall be performed on the cable utilizing a test voltage acceptable to owner and not exceeding 60 percent of factory test value.

iv. Test Values:

a. Shielding must exhibit continuity. Investigate resistance values in excess of ten ohms per 1000 feet of cable.

b. Graphic plots may be made of leakage current versus step voltage at each increment and leakage current versus time at final test voltages.

i. The step voltage slope should be reasonably linear.

ii. Capacitive and absorption current should decrease continually until steady state leakage is approached.

2. High-Voltage - Reserved

260500 COMMON WORK RESULTS FOR ELECTRICAL

- The following is a guide to all Architects and Engineers performing work for the University of Illinois at Chicago Campus, pertaining to review and comment procedures as required by the University. Deviations will be allowed only by special

permission of the University.
- "Procedures, Codes and Planning Requirements," Divisions 0 and 1 shall also apply to the work under Division 26, Electrical.
- Refer to the UIC Telecommunications Building Standards for specific requirements regarding computing and communications.

260513 MEDIUM VOLTAGE CABLES

- Refer to the UIC Telecommunications Building Standards for specific requirements regarding computing and communications.
- Medium Voltage Ground Conductor for Power and Lighting: All medium voltage power circuits in duct must be paralleled by a grounded conductor intended to minimize fault current in power cable shields. The ground conductor shall be THWN insulation, rated at 600 volts, and minimum size of number 2/0 AWG.
- Building Wire: All branch circuit wiring in new buildings should be in accordance with an established color code. Wiring installed during remodeling should be in accordance with the color code established when the building was constructed, or in accordance with an established color code if none exists. Conductors #10 and larger shall be stranded wire.
- Power cable (5,000 and 15,000 Volt) is for extension of campus electric distribution system to buildings and should be installed in strict accordance with manufacturer's recommendations. Cables should be installed in rigid conduit inside buildings and in concrete encased duct outside of buildings. Wye splices in power cables are not allowed, and no splices should be installed in duct runs. Where cables pass through manholes, they should be placed on racks with insulators. Where cables pass from manholes into duct runs or conduits, duct shields are required for protection of the cable. Cables shall be fireproofed and tagged in manholes and other locations where exposed and labeled with plastic tags.
- Medium Voltage Ground Conductor cable is necessary to limit power cable shield current when power cable failures occur. Between manholes, the cable may be installed in the same duct cell as power circuits. Splices in duct runs are unacceptable. Where this cable passes through manholes, it should be bonded to ground rod and power cable shields of all spliced power cables. At source and load ends of power cables, this cable should be bonded to source and building grounding systems. At cable splices, the power cable shields should be extended individually to this ground conductor system.
- Grounding rods shall be copper clad flashed in 8 ft. lengths with exothermic weld connections for wiring attachment.

260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- The steel enclosures and supports of the electrical equipment and all metal conduits in the transformer room shall be connected to earth by copper bar ground bus. The neutral of the secondary winding of the transformer and the neutral bus of the secondary switchgear compartment of the unit sub-station shall be grounded. The ground shall be bolted to the walls every 4 feet. An equivalent bare copper conductor installed in conduit shall be extended from the ground bus in the switchgear to the water main ahead of the meter, and secured by means of a ground clamp. A full size bonding jumper shall be furnished across the water meter. For additional protection, a supplemental ground consisting of at least three copper weld ground rods, spaced 20 ft. or more apart and each 10 ft. long x 3/4 in. diameter shall be driven into the earth through the floor of the basement and connected to the ground bus by bare copper ground conductors and clamps. The grounding system shall be complete including the metal frame of the building and the building rebar.

260533 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

- Raceways:
  Refer to the UIC Telecommunications Building Standards for specific requirements regarding computing and communications.
- Electrical Standards for Low Voltage Systems:
  1. New Buildings: In new buildings the University Building Standards require compliance with applicable portions of the current National Electric Code regarding low voltage systems. All wiring must be installed in metallic raceways, and in finished areas the raceways are to be concealed.
  2. Existing Buildings: In existing buildings, all fire alarm and emergency lighting system changes and additions shall meet requirements for new buildings, with each system having its own metallic raceway system. For other low voltage systems and low voltage wiring in existing buildings, the National Electric Code shall be followed.
     a. In finished areas, where it is difficult to use existing concealed raceways, surface metallic rectangular raceways and boxes shall be installed in approved locations. All holes through walls and floors shall have galvanized or plastic sleeves and be finished in a neat manner. Patching and refinishing shall match that of existing adjacent construction with regard to both material and appearance. Holes, sleeves and cables in exterior walls and foundations shall be permanently sealed on the outside to prevent entrance of water and

insects. Surface raceways and boxes must be firmly and permanently attached to walls and ceilings by use of anchors. Sleeves through floors shall extend at least 3/8" above the floor line and be sealed to prevent leaks to the floor below.

b. Installation of exposed low voltage circuits for other systems is not permitted.

- Boxes:
  1. Outlet boxes for recessed fixtures shall be installed with max. 4ft. Greenfield from fixture outlet box to allow fixture to be dropped for servicing.
  2. Switch and receptacle boxes shall be:
     a. Complete with 1" minimum depth tile ring where used in exposed tile.
     b. Complete with 1" minimum depth plaster ring where used in plastered walls.
     c. Installed with 1/2" raised galvanized device covers where used for exposed conduit work.
  3. Pull boxes and junction boxes shall be entirely accessible.

260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS

- Raceway and Cable Labels:
  1. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
     a. Color: Black letters on orange field.
     b. Legend: Indicates source, destination, voltage and substation.
  2. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.
  3. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
  4. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
  5. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
     a. Not less than 6 inches wide by 4 mils thick.
     b. Compounded for permanent direct-burial service.
     c. Embedded continuous metallic strip or core.
     d. Printed legend indicating type of underground line.
  6. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
  7. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch-thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
  8. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.
  9. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.
  10. Brass or Aluminum Tags: 2 by 2 by 0.05-inch metal tags with stamped legend, punched for fastener.
- Nameplates and Signs:
  1. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
  2. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
     a. Engraved legend with black letters on white face.
     b. Punched or drilled for mechanical fasteners.
  3. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
  4. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
  5. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.
- Miscellaneous Identification Products:
  1. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
     a. Minimum Width: 3/16 inch.
     b. Tensile Strength: 50 lb minimum.
     c. Temperature Range: Minus 40 to plus 185 deg F.
     d. Color: According to color-coding.
  2. Paint: Formulated for the type of surface and intended use.
     a. Primer for Galvanized Metal: Single-component acrylic vehicle

formulated for galvanized surfaces.
b. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
c. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
d. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

- Installation:
  1. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
  2. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
  3. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
  4. Self-Adhesive Identification Products: Clean surfaces before applying.
  5. Circuits with More Than 600 V: Identify raceway and cable with "DANGER--HIGH VOLTAGE" in black letters 2 inches high, stenciled with paint at 10-foot intervals over a continuous, painted orange background. Identify the following:
     a. Entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
     b. Wall surfaces directly external to conduits concealed within wall.
     c. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
     d. Entire surface of exposed conduits.
  6. Install painted identification according to manufacturer's written instructions and as follows:
     a. Clean surfaces of dust, loose material, and oily films before painting.
     b. Prime surfaces using type of primer specified for surface.
     c. Apply one intermediate and one finish coat of enamel.
  7. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
     a. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
     b. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
     c. Apply the following colors to the systems listed below:
        i. Fire Alarm System: Red.
        ii. Fire-Suppression Supervisory and Control System: Red and yellow.
        iii. Security System: Blue and yellow.
        iv. Mechanical and Electrical Supervisory System: Green and blue.
        v. Telecommunication System: Green and yellow.
  8. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
  9. Circuit Identification Labels on Boxes: Install labels externally.
     a. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
     b. Concealed Boxes: Plasticized card-stock tags.
     c. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
  10. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
  11. Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder and branch-circuit phase conductors:
      a. 208/120-V Conductors:
         i. Phase A: Brown.
         ii. Phase B: Orange.
         iii. Phase C: Yellow.
      b. 480/277-V Conductors:
         i. Phase A: Brown.
         ii. Phase B: Orange.
         iii. Phase C: Yellow.
      c. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
         1. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no

tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.

2. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

12. Power-Circuit Identification: Metal tags, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
    a. Legend: 1/4-inch-steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
    b. Tag Fasteners: Nylon cable ties.
    c. Band Fasteners: Integral ears.
13. Apply identification to conductors as follows:
    a. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
    b. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
    c. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
14. Apply warning, caution, and instruction signs as follows:
    a. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
    b. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
15. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch-high lettering on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
    a. Panelboards, electrical cabinets, and enclosures.
    b. Access doors and panels for concealed electrical items.
    c. Electrical switchgear and switchboards.
    d. Electrical substations.
    e. Emergency system boxes and enclosures.
    f. Motor-control centers.
    g. Disconnect switches.
    h. Enclosed circuit breakers.
    i. Motor starters.
    j. Push-button stations.
    k. Power transfer equipment.
    l. Contactors.
    m. Remote-controlled switches.
    n. Dimmers.
    o. Control devices.
    p. Transformers.
    q. Inverters.
    r. Rectifiers.
    s. Frequency converters.
    t. Battery racks.
    u. Power-generating units.
    v. Telephone switching equipment.
    w. Clock/program master equipment.
    x. Call system master station.
    y. TV/audio-monitoring master station.
    z. Fire alarm master station or control panel.
    aa. Security-monitoring master station or control panel.
    ab. Card reader control enclosure.

261000 MEDIUM VOLTAGE ELECTRICAL DISTRIBUTION

- Where possible, distribution and branch circuit panels installed in finished areas shall be flush mounted and served through concealed conduit. Branch circuit panels shall be located so that they will be not more than 65 feet from any portion of the floor

served, so that branch circuits will not exceed 100 feet in total length. All flush mounted panels shall have at least four spare one-inch conduits extended to space above or near the ceiling.

- Protective devices in branch circuit and distribution panels which are rated 400 amperes or less shall be circuit breakers with appropriate short circuit ratings to maintain building coordination. Circuit breakers shall have bolt or screw mounting to bus. Push-n mounting to bus is unacceptable.
- Branch circuit breakers for lighting and convenience receptacles shall be 20 amperes. Lighting and receptacles shall be connected to separate circuits.
- All new distribution and branch circuit panels shall have a minimum of 42 spaces. In addition, all new panels shall have a minimum of nine spare spaces when installation is complete.
- New branch circuit panels shall have minimum of five-inch gutters, with additional gutter space being provided for feeder lugs or main breaker as required for particular installations.
- All distribution and branch circuit panels shall be lockable. Panels with interiors and trims which do not allow use of this lock are unacceptable.
- Each panel shall contain a typewritten schedule. The schedule shall contain complete and detailed information for loads on each circuit.

261116 SECONDARY UNIT SUBSTATIONS

- Electrical Room and Distribution Equipment:
    1. Buildings shall be equipped with interior transformer rooms as herein described. The rooms shall contain the primary disconnect switch; building transformer; main circuit breaker and secondary switchgear; signal cable terminal box; and McCulloh Loop fire alarm cable terminal.
    2. Management should be consulted to verify what primary voltage is available.
    3. A building with expected maximum demand of over 750 KVA generally should have two separate transformer rooms of equal capacities in different parts of the building or in a double-ended arrangement in one transformer room. Buildings with large auditoriums and other structures that may be occupied by large numbers of people should have two separate transformers to insure reliability of the lighting. Equipment, where the maximum demand is approximately 150 KVA or more, shall be of the "unit sub-station" type, all in one factory assembled unit. Switchboard equipment shall include watt-hour demand metering with 15-minute interval demand - multiplier of 1, 10, 100, 1000 and pointer type for KW indicators and dial type for KWH indicators, (Westinghouse type Mark IA, or GE type M-30 are preferred) ammeter and voltmeter with phase selection switches. Facilities Management shall be consulted if there are questions on metering arrangements and the multiplier. Potential fuses for watt-hour meter shall be provided inside the switchboard and be readily accessible from the exterior. The secondary buses in large units shall be located and sectionalized for quick disconnecting so as to facilitate moving the transformer and load break switch portion of the unit sub-station in and out of the room separately from the secondary switchgear portion of the unit. All sub-station bus conductors shall be silver plated copper.
    4. If the transformer in the room is 150 KVA capacity or more, the secondary distribution shall be part of a floor-mounted switch group. This switch group shall contain the current transformers, the kilowatt-hour meter, the demand meter, and all necessary overcurrent protection devices. Buildings with smaller room capacity than 150 KVA may have the secondary distribution in cabinets mounted in the transformer compartment.
    5. The short circuit current calculations shall be required and shall form the basis for the following:
        a. All secondary overcurrent protective devices to be utilized within the building unit substations, distribution panels, branch circuit panels, motor control centers, and devices on plug-in bus-duct circuit current to the proper value for the protection of connected downstream components.
        b. All protective devices are to be coordinated for a purely selective system and fusible switch type equipment shall be used where required.
        c. The main secondary overcurrent protective devices shall be selected for protection of the transformer and shall provide a selective system between the primary fuse and each feeder protection device.
        d. Each feeder protection device shall be selected for protection of the feeder conductors and coordination between the primary fuse, secondary main and other load side components fed by the feeder device.
    6. There should be no fire protection sprinkler, steam, gas, water, sewer or air pipes in the transformer room, or any other equipment requiring attention by anyone except authorized electrical personnel. Fluorescent lighting fixtures shall be provided, illuminating both the front and back of the unit sub-station. Provide a switched duplex outlet located near the door. Connect the lights to an emergency circuit. All transformer rooms are to be heated.
    7. Provide a one-line diagram of the building distribution system from the incoming high voltage feeder to the last low voltage distribution panel. This drawing is to be framed under glass and securely mounted to the wall in the

transformer room. The following information shall be shown on the drawing: all conduit sizes, wire sizes and types, maximum amperage of devices, voltage of devices, fuse or circuit breaker rating, main lugs or size of the main breaker for panels, the number of circuits for panels and panel locations.

8. The electrical design shall take into consideration power system harmonics. The transformer shall be K factor rated where applicable.
9. Transformer rooms should be heated and ventilated year round with a minimum of 4 cfm per KVA of transformer capacity. The exact configuration of the ventilation shall be determined during the formal review process.
10. All unit substations are to have cooling fans that are controlled by a digital temperature controller. Each coil of the transformer is to be monitored by the temperature controller. The temperature controller is to have a local alarm feature and is to be capable of initiating a remote alarm. The back sides of unit substations are to be installed a minimum of 36 inches away from the wall.
11. Transformers shall be impedance matched.

261200 MEDIUM VOLTAGE TRANSFORMERS

- Suggested procedure to establish transformer capacity:
  1. Demand factor for receptacle loads shall be applied with consideration for the type of usage.
  2. Total KVA demands shall be increased 25 per cent for reasonable future growth and subsidiary loads.
  3. Review the load calculations data and transformer KVA capacities with Facilities Management before proceeding with final design layouts.

261300 MEDIUM VOLTAGE SWITCHGEAR

- All main-tie-main disconnect arrangements shall be drawout type only, with a "kirk key interlock" system included.

261313 CIRCUIT BREAKER SWITCHGEAR

- Fusible main secondary switch:
  1. Switches over 601 amps shall be quick-make, quick break, bolted pressure switch(es) equal to Barkelew "Bolt-Loc" pressure contact switch complete with current limiting, time delay, hi-capacity fuses with 200,000 ampere interrupting capacity. S&C Electric is the preferred fuse manufacturer.
  2. Switches under 601 amps shall be molded case circuit breakers or fused switches where the interrupting capacity of the device is greater than that of the transformer feed.
- Feeder circuit breaker devices: Shall be manually or electrically (as required) operated, draw-out type or molded case, in the proper pole arrangement, and possess current ratings and interrupting capacity. Under no circumstances shall drawout breakers be fixed (bolted in). In addition, all main-tie-main breakers shall be drawout only with a "kirk-key interlock" system included.
- All electrical equipment such as sub-stations, bus-duct, panelboards and motor control centers must be constructed to withstand the short circuit current, symmetrical and asymmetrical, for the number of cycles as required by the rating of the particular overcurrent protective device.
- Campus lights, steam tunnel lights, pumps, outdoor tennis courts, or an adjacent building may be supplied with power from the secondary switchgear of the building. Branch circuit overcurrent device, especially for these subsidiary loads, shall be a part of the secondary switchgear in the room.

261839 MEDIUM VOLTAGE MOTOR-CONTROLLERS

- Manufacturer Qualifications: Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- Provide products by one of the following preferred manufacturers:
  1. Motor-Control Centers with Manual and Magnetic Controllers:
     a. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
     b. Eaton Corp.; Cutler-Hammer Products.
     c. General Electrical Distribution & Control.(d) Rockwell Automation Allen-Bradley Co.; Industrial Control Group.
     d. Siemens/Furnas Controls.
     e. Square D Co.
  2. Motor-Control Centers with Variable-Frequency Controllers:
     a. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
     b. Danfoss Inc.; Danfoss Electronic Drives Div.
     c. Eaton Corp.; Cutler-Hammer Products.
     d. General Electrical Distribution & Control.
     e. MagneTek Drives and Systems.
     f. Rockwell Automation Allen-Bradley Co.; Industrial Control Group.
     g. Siemens/Furnas Controls.
     h. Square D Co.
- Frame printed operating instructions for motor-control centers, including control

sequences and emergency procedures. Fabricate frame of finished metal and cover instructions with clear acrylic plastic. Mount on front of motor-control centers.

262413 SWITCHBOARDS

- Fusible Main Secondary Switch Units:
  1. When required, shall be quick-make, quick-break, bolted pressure switch(es) (equal to Barkelew "Bolt-Loc" pressure contact switch) complete with current limiting, time delay, hi-capacity fuses with 200,000 ampere interrupting capacity.
- Fusible Feeder Switch Devices:
  1. Main switches larger than 600 amperes shall be quick make, quick break, bolted pressure switches with NEMA type L fuses. (Equal to Barkelew "Bolt-Loc" pressure contact switch.)
  2. Fuses for all switches shall be U.L. listed, current limiting, time delay, silver link, fuses with 200,000 ampere interrupting capacity. Dual element fuses shall be self-protecting from extraneous heat.
  3. After installation, the unit sub-station shall be energized for test and the secondary voltages checked for phase rotation between phases, and between each phase and neutral before the main secondary overcurrent protective device is closed. All conductors at the main secondary protective device shall be clearly identified with 1 in. high stencil letters with orange-colored paint.
  4. Bussman is the preferred manufacturer of medium voltage fuses.
- Feeder Circuit Breaker:
  1. Shall be manually or electrically (as required) operated, draw-out type or molded case, in the proper pole arrangement, and possess required current ratings and interrupting capacity.
  2. All electrical equipment such as sub-stations, bus-duct, panelboards and motor control centers must be constructed to withstand the short circuit current, symmetrical and asymmetrical, for the number of cycles as required by the rating of the particular overcurrent protective device.
  3. Campus lights, steam tunnel lights, pumps, outdoor tennis courts, or an adjacent building may be supplied with power from the secondary switchgear of the building. Branch circuit overcurrent device, especially for these subsidiary loads, shall be a part of the secondary switchgear in the room.

262419 MOTOR CONTROL CENTERS

- Starters for motors shall be of the magnetic type as required for the respective motor service, complete with overload protection, in all three phases. Motor control center shall be used where economically possible. Combination starter-fuse disconnect units shall be installed in either motor control centers or individual enclosures provided at each motor installation not in sight of the motor controller.
- Starter selection shall be based on the following table for particular installations. If the motors are fed from the same transformer that supplies the building lighting and receptacle loads, then the inrush KVA shall not exceed 20% of the transformer KVA rating. Inrush KVA shall be computed using the mid-range value of the code letter designation of the motor. A table showing the maximum horsepower permitted for different size transformers based on motors with a code letter "G" has been supplied as a sample.
- Code "G" has a mid-range value of 6 KVA per horsepower.

KVA of	Maximum Across-the-Line HP
100	5
200	7.5
300	10
500	15
750	25
1000	30

- Project electrical designers shall direct special attention to power quality issues relating to power line disturbances caused by starting or operating large electrical loads. The final electrical design shall address power quality by the use of reduced voltage starters, electronic "soft start" solid state starters, or any other necessary means.

262726 WIRING DEVICES

- All devices, switches, receptacles, and cover plates shall be specification grade.
- Switches shall be composition body, flush tumbler, quiet type.
- Interior cover plates in finished offices, classrooms, and other general purpose occupancies shall be #430 brushed stainless steel. Interior cover plates in laboratories and other potentially corrosive occupancies shall be #302/304 brushed stainless steel.
- Interior cover plates in unfinished areas shall be stamped galvanized for sheet metal boxes and cast for cast boxes.
- Outdoor cover plates shall be gasketed, weatherproof, spring loaded lid, and suitable to protect the receptacle during use.

- Lighting switches shall be located six inches horizontally from door jambs.
- Where switches are together at one location they shall be ganged.
- Switches controlling or disconnecting motor loads shall be horsepower (HP) rated.
- Install all wall switches with OFF position down.
- Install receptacles with grounding pole on bottom for vertically mounted receptacles, and on the right for horizontally mounted receptacles.
- Cover plates shall be installed flush and level.
- Receptacle cover plates shall be labeled with the panelboard and circuit designation when requested by the department occupying the finished space. This requirement shall be defined during the project's design phase.
- High quality, high sensitivity, surge arrestor receptacles shall be required in areas that serve personal computers or other sensitive electronic equipment when requested by the department occupying the finished space. This requirement shall be defined during the project's design phase.
- Methods of Wiring:
- All of the conductors shall be run in grounded metallic conduits. Equipment and devices installed and not constructed with enclosures suited for mounting or enclosing all live parts shall be installed in grounded metal cabinets.
- All conduits shall be run to the distribution cabinets in a neat, accurate manner and shall be installed concealed in ceiling and wall construction where possible or exposed at right angles at roof purlin and beam locations as required.
- All conduit shall be swabbed until all moisture and grit is removed before any wires are pulled or installed.
- Wire pulling compound may be used to ease the pulling of wire or cable. Excess compound must be removed.
- Installing fluorescent light fixtures with rubber cord, receptacle and plug is not acceptable.
-

Raceways and Conduits:

1. General
    a. All conductors shall be installed in metallic conduit.
    b. All conduit shall be sized according to the National Electric Code except that minimum allowable size shall be 3/4" .
    c. All conduit bends shall be long radius.
    d. Coordinate all conduit locations with other trades before roughing-in.
    e. Three (3) 1" conduits, for future use, shall be installed from each flush mounted panel and turned into the joist space above the panel.
2. Electrical Metallic Tubing (EMT)
    a. EMT shall be:
        i. Galvanized zinc exterior coating.
        ii. Lacquer coated interior.
        iii. Installed in masonry walls.
        iv. Installed above ceilings in joist spaces.
    b. EMT shall:
        i. Not be used for exterior installations.
3. Rigid Heavy Wall Conduit (Rigid)
    a. Rigid shall be:
        i. Galvanized steel.
        ii. Installed in concrete slabs and walls. (1" minimum concrete covering).
        iii. Installed in exposed exterior locations above grade.
        iv. Reamed after cutting threads.
        v. 3/4" minimum allowable size.
        vi. Coupled with a 3-piece coupling in lieu of running threads.
        vii. Installed with joints sealed with copper coat conductive, anti-corrosive surface treatment.
4. Flexible Conduits
    a. Flexible conduit shall be:
        i. Greenfield type in all dry locations with compression type connectors.
        ii. Liquid-tight type in all wet locations (including all exterior locations) with ferrule and sleeve type connections.
        iii. Used for the final connection to all motors and vibrating equipment.
        iv. Used for the final connection to all recessed fixtures.
    b. General
        i. All straps and clamps shall be galvanized steel.
        ii. Support every 6 ft. min. for conduits 1" and smaller.
        iii. Support every 5 ft. min. for conduits over 1".
        iv. Supports for suspended conduits shall be threaded steel rods.
        v. Anchor rods to inserts in concrete.
        vi. Anchor rods to beam clamps on steel structure.
5.

    Surface mounted conduits
    a. Use one hole straps.
    b. For EMT use stamped steel straps.
    c. For rigid conduit use malleable iron straps and pipe spacers.
6. Suspended conduits

a. Individual conduits: Use Minerallac galvanized conduit clamps with proper threaded rod.
b. Two or more conduits adjacent to each other:
    i. Use painted channel 1-5/8" x 1-5/8" constructed from 12 gauge steel hung from at least two rods.
    ii. Use suitable galvanized split pipe clamps for rigid and EMT conduit.

262923 VARIABLE FREQUENCY MOTOR CONTROLLERS

- Variable Frequency Drives (VFMC) shall be used in mechanical systems to conserve energy. Typical applications include motors for pumps, air handling unit fans, or chillers. The VFMC shall be coordinated for the specific system application by the VFMC, motor, and driven equipment manufacturers. VFMC units installed in existing systems must maintain all existing safety devices in both VFMC and bypassed modes. Typical safety devices include high and low pressure controls, low temperature freeze protection and high temperature fire protection.
- The VFMC shall be subject to the following parameters and tests:
    1. All integrated circuits (TTL) and all components used for circuit board construction shall be tested to an acceptance criteria of 0.5% AQL (Accepted Quality Level).
    2. In-circuit testing of all printed circuit boards shall be conducted to insure proper mounting and correct value of all components.
    3. Final printed circuit board assemblies shall be functionally tested via computerized test equipment where all tests and acceptance criteria are pre-programmed and test results are stored as detailed quality assurance data.
    4. All fully assembled controls shall be combined-tested for performance and functionality at the manufacturer's factory with fully loaded VFMC rated induction motors. The combined test data shall then be analyzed to insure adherence to quality assurance specifications.
- Power components shall undergo 168 hours factory burn in, circuit boards shall be tested under thermal cycling and the complete unit shall be tested under full load conditions to insure maximum product reliability.
    1. The VFMC radio frequency interference/electro-magnetic interference emission (radio noise) will be below limits as set forth by the Federal Communication Commission Rules and Regulations Class A Computing Devices, Subpart J. The VFMC manufacturer will furnish laboratory test results showing that noise levels above 10 KHz as well as SCR's firing angle, GTO's or transistors that produce high frequency noise to be conducted back on the power lines must meet FCC standards.
    2. To insure compatibility with future equipment, the manufacturer shall have one design to cover the range of 1 to 1 50 Hp.
    3. The VFMC manufacturer shall have a minimum of 5 years experience in VFMC manufacturing.
    4. The VFMC shall be designed to meet the power line transient condition defined with IEEE-587; protected against line transients as great as 6 KV without failure (Excluding fuses).
- The system and components shall be supplied by one manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least three years and who shall be able to refer to similar installations rendering satisfactory service.
- All VFMC's shall be guaranteed for two calendar years from the date of owner acceptance. The vendor, at his expense and without extra charge to the University, and within a reasonable period of time after being contacted by the University shall provide labor and material to repair or replace any defects in materials and workmanship on the VFMC which may develop or appear during the two year period. This guarantee also includes any damage to other work caused by such defects or the repairing of same.
- Preferred manufacturers and their series:
    1. B & G Series
    2. ABB - ACS500 Series
    3. Toshiba - VT130 H2 Series
    4. Danfoss - VLT Series
    5. Square D - Altivar 16 Series
    6. Allen-Bradley - 1336 Plus Series
- All VFMC's shall be a pulse width modulated (PWM) design that has a carrier frequency of 8 KHz or higher so no acoustic noise will be produced onto the motor. The VFMC shall generate a sine-coded, adjustable voltage/frequency three phase output for complete speed control of any NEMA B VFMC duty squirrel cage induction motor. The VFMC shall maintain a 120% current overload capability for 60 seconds with automatic stall prevention and voltage boost to prevent nuisance tripping during load or line side transient conditions. The VFMC shall maintain a power factor of not less than 0.95 throughout its speed range. The VFMC shall be 95% efficient of 100% rated output power at 60 Hz.
- Service: VFMC manufacturer shall have the following available:
    1. Service engineer.
    2. Training/service schools.

3. 24-hour phone service.

- Testing: The VFMC manufacturer shall make an inspection of the equipment including those components necessary to the direct operation of the system. All test and report costs shall be borne by the supplier. The inspection technician shall prepare a checkout report and the original submitted to Facilities Management and a copy shall be registered with the equipment manufacturer. The report shall include, but not be limited to:
  1. A complete list of equipment installed and wired.
  2. Indication that all equipment is properly installed and functions and conforms with these specifications.
  3. Physical tests of each individual device.
  4. Serial numbers, locations by device and model number for each installed device.
  5. That the wiring connections to all equipment components show that the installer undertook to have observed the National Electrical Code.
  6. That the equipment of the manufacturer has been installed in accordance with the manufacturer's recommendations, and that all signaling devices of whatever manufacture have been operated or tested to verify their operation.
  7. That the supervisory wiring of those items of equipment connected to a supervised circuit is operating and have been met to the satisfaction of inspecting officials.
  8. Technicians name, certificate number and date.
  9. The manufacturer shall supply all technical assistance with respect to any changes necessary to ensure a complete, workable system. During the period of inspection by the manufacturer, the electrical contractor shall make available electricians for whatever changes deemed necessary by the manufacturer at the contractor's cost.
- Labeling:
  1. All user connection points shall be labeled with self adhesive labels that clearly identify the terminal as it is shown on the shop drawings.
  2. If the readout is digitally coded for faults and other VFMC information, a decoding legend must be affixed to the front of the VFMC indicating what these codes mean.
- User Agency Training: The system manufacturer or authorized distributor shall provide training for users, with the initial session to occur when the system is accepted by the Operation and Maintenance Division.
  1. On Site Training Personnel:
     a. Four (4) hours of instruction including an overview of the system and its capabilities, what to do in case of alarm or trouble.
     b. Eight (8) hours of instruction as in both items above in addition to maintenance instruction on each type of device connected to the system, all modules involved in the control panel and all aspects of user-accessible programming
     c. Training is to be at the expense of the manufacturer. Lodging, meals and transportation are a Facilities Management expense.

2632000 FACILITY ELECTRICAL POWER GENERATING AND STORING EQUIPMENT

- Manufacturer must maintain a service center capable of emergency maintenance and repairs at the Project with eight hours' maximum response time.
- Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace packaged engine generator and auxiliary components that fail in materials or workmanship within specified warranty period of five (5) years from date of Substantial Completion.
- At Substantial Completion, begin 12 months full maintenance by skilled employees of the manufacturer's designated service organization. Include quarterly exercising to check for proper, starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts and supplies as used in the manufacture and installation of original equipment.
- Provide products by one of the following preferred manufacturers:
  1. Caterpillar, Inc.; Engine Div.
  2. Generac Corp.
  3. Kohler Co; Generator Division.
  4. MagneTek, Inc.
  5. Onan Corp; Industrial Business Group.
  6. Penn Detroit Allison.
  7. Spectrum Detroit Diesel.
  8. Stewart & Stevenson Services, Inc.
  9. Western Diesel Service.
- Fuel: Natural Gas
  Functional Description: When the mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic-transfer switches initiate starting and stopping of the generator set. When the mode-selector switch is switched to the on position, the generator set manually starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote

emergency-stop switch also shuts down the generator set.

- Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators as specified below:
    1. Coordinate this training with that for transfer switches.
    2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
    3. Review data in maintenance manuals. Refer to Division 1, Section 017700 (Closeout Procedures).
    4. Review data in maintenance manuals. Refer to Division 1, Section 017823 (Operation and Maintenance Data).
    5. Schedule training with Owner, through Architect, with at least seven days advance notice.
    6. Minimum Instruction Period: Eight hours.

263600 TRANSFER SWITCHES

- Zenith transfer switches are preferred.

BUILDING STANDARDS

DIVISION 27 -- COMMUNICATIONS

270000 TELECOMMUNICATIONS

- Refer to the UIC Academic Computing and Communication Center Telecommunication Building Standards, accessible from their web page at http://www.uic.edu/depts/accc/telecom/ted.html

271113 COMMUNICATIONS ENTRANCE PROTECTION

- The system will include card readers at entrance doors, electric hardware and monitoring at each door, microprocessor based intelligent controllers, dual reader controllers wiring between controllers in a building, software, hardware, and firmware for the microprocessor based controllers and the host computer.
- The requirements for the Card Access system will be included in a project's Program Statement. Upon consultation with the building's occupants, University Police, and Facilities Management, the requirements shall be refined during the project's design phase. In order to completely integrate this system into a construction project the details shall be developed for inclusion to the 50% design review.
- Acceptable Manufacturers
    1. Lenel Systems International (www.lenel.com).
    2. Best Access Systems (www.bestaccess.com).
    3. Radionics, Inc. (www.radionicsinc.com).
    4. RS2 Technologies (www.rs2tech.com).
- All hardware, firmware, and software furnished shall be the manufacturer's latest revision or product version, at the time of final acceptance.
- All material and equipment shall be new and unused.
- Security System Controller:
    1. The card access controller shall have the following characteristics:
        a. Capability to control two access controlled doors with hardware and software to accomplish the following within a distance of 500 feet from the controller:
            i. Two card readers
            ii. Two latch position switches
            iii. Two electric strikes
            iv. Two door position switches
            v. Two sets of panic hardware
        b. The unit shall have the following electrical characteristics:
            i. Normal 120 volt A.C. power supply. 2. 12 volt batteries for two hours of standby operation. 3. 12 volt D.C., fused at one amp, for control of electric strikes.
        c. The system shall operate and allow controlled card access without connection to the host computer. It shall have a memory capacity to handle 2000 cards in this non communicating mode of operation.
- Modems:
    1. Modems shall be furnished and installed to connect the intelligent controllers to the host computer when the total wire distance between units is over 4000 feet. Two modems shall be furnished and installed: one at the intelligent controller; and one at the host computer site.
    2. The modems shall be furnished as part of the hardware/software/firmware package to insure system compatibility.
- Security System Boxes:
    1. Refer to Section 260533. Individual outlet boxes shall consist of a standard four inch square outlet box with appropriate plaster rings where required in walls. Mounting height shall be as indicated on drawings.
    2. Cover plates: The contractor shall provide a blank stainless steel cover plate for all outlet boxes.
- Pull String:
    1. A nylon pull string shall be installed in all future or empty conduits installed for the card access control system.
- Raceway:
    1. See Section 260533. Raceway shall be EMT and shall be sized as shown on the contract documents. Minimum size of conduit shall be 3/4. Use only compression couplings designed specifically for the type of conduit or raceway utilized. Use 1/2 inch minimum flexible metallic conduit when running conduit in door frames. Provide insulated bushings at conduit termination.
- Install interior raceway system with maximum of 270 degrees of total bends, or 150 feet of total distance, between outlets or junction boxes. Raceways for the card access system shall not share raceways or cable trays with other systems such as power, telecommunications, fire alarm., or department operated network systems.
- Install conduit at the location shown on the drawings. Where plywood backboard is shown, stub conduit up to a level two inches above bottom of backboard and secure to backboard.
- Extend raceway from each security wall outlet directly to the serving Diebold 1000 card access controller.
- All security conduits shall be concealed and all boxes flush mounted.

- See contract documents and shop drawings for mounting heights of devices and equipment. This contractor shall be assigned the responsibility to coordinate the mounting heights and details of the components of the card access system. No surface mounted raceways shall be allowed unless specifically defined in the contract documents.
- Conduit Sizing:
    1. Conduit sizes are shown on the drawings, however, all conduit sizes shall be verified with the Architect/Engineer before rough in for proper size.
- Boxes:
    1. Install one box for each security outlet and junction point. All Boxes shall be flush mounted. This contractor shall be assigned the responsibility to coordinate the mounting heights and details of the components of the card access system. No surface mounted boxes shall be allowed unless specifically defined in the contract documents.
- Equipment Mounting and Location:
    1. The card access controller shall be mounted in electrical closets as indicated on the contract documents. All mounting locations shall be readily accessible and within locked spaces. Mounting above ceilings and other inaccessible spaces shall not be allowed.
    2. Control and other panels shall be mounted with sufficient clearance for observation and testing. All security system junction boxes shall be clearly marked. All wiring shall be in conduit.
- Card Access Controller Firmware:
    1. All firmware necessary for a complete and fully functioning system shall be furnished. Including firmware for complete communication with the Host computer.
- Host Computer Software:
    1. All software necessary for configuring this new system to the University of Illinois at Chicago's' existing system for complete and fully functioning system shall be provided.
- Card Readers:
    1. Card readers shall be furnished and installed by the contractor. The exact quantity and type shall be determined during the project's preliminary design phase. The final configuration for card readers shall be determined after consultation with the occupying department, University Police, and Facilities Management.
    2. Do not install in the direct path of egress. Install in a secured location, i.e., electrical closet, as approved by the University.
- Wiring:
    1. All wiring shall be shielded per manufacturer direction, checked and testing to insure that there are no grounds, opens, or shorts.
    2. No wiring other than that directly associated with card access system or its auxiliary functions shall be in card access system conduits. Wiring splices shall be avoided to the extent possible, and if needed they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc., shall be clearly labeled on all equipment panels.
    3. Provide, as required, audible suppression devices for interference-free and properly operational system and that both audible and multiplex wiring be run in same raceway.
- Final Test
    1. Tests:
        a. The contractor shall perform all electrical, software, hardware, and mechanical tests required by the equipment manufacturer's standard check out procedure.
        b. The system final test shall be conducted under the direction of a technician certified by the manufacturer.
    2. Required Submissions:
        a. At the time the system is tested, the Contractor shall supply the following items to the University before the test is started:
            i. Drawings showing the floor plan of the building, all device locations, and device addresses, Card Access Controller locations, wiring between the units, and the location of the modem.
    3. Scheduling and Sequencing of Tests:
        a. Final testing of the system shall not occur until the entire system is 100% complete and fully functioning. In the event that phased construction schedules require partial system operation, portions of the system may be tested. However, the entire system must be operating and fully functional before final testing, final acceptance and substantial completion shall be allowed to occur.
        b. The final test shall be scheduled so that it may be witnessed by the Architect/Engineer and University personnel. This shall require notifying

the above referenced groups, in writing, a minimum of seven working days in advance of the final test.

4. Final Report Contents:
    a. The report shall include:
        i. A complete list of equipment installed and wired
        ii. Indication and demonstration that all equipment is properly installed and functions and conforms with these specifications
        iii. Tests of each individual device
        iv. Voltage and current settings for each device while in operation or in each state (such as open or closed)
        v. Demonstration of communication, alarm transmission, monitoring, and remote programming of the local units from the Host Computer
        vi. Technician's name, address, telephone, FAX, ID Number, and date
    b. After completion of all the tests and adjustments listed above, the contractor shall submit the following information to the architect and the Facilities Management:
        i. "As-built" conduit layout diagrams including wire color code and/or tag number
        ii. Complete "as-built" wiring diagrams.
        iii. Detailed catalog data on all installed system components.
        iv. Copy of the final test report.
        v. Drawings showing the floor plan of the building, device locations, and device addresses.
    c. Final tests and inspection shall be held in the presence of Architect, University Project Management and Facilities Management Representative and conducted to their satisfaction. The contractor shall supply personnel and required auxiliary equipment for this test without additional cost. Any problems identified during system testing must be corrected by reprogramming or other corrective work. After the reprogramming or other work is complete, the Contractor shall submit corrected documentation to the University.
    d. The completed access control system shall be demonstrated to insure its proper operation. This demonstration shall consist of activating the installed system and all its features. The card access system shall be demonstrated with a several cards, all door monitoring functions shall also be demonstrated. The test shall include observation of all host software functions and their accurate reporting of the field conditions. The test must include accessing the system software in the existing Host Computer. The contractor shall furnish all system passwords, communication software, and system software to demonstrate. The software and passwords shall remain with the University for use in the continuing operation and maintenance of the system.

- Final Acceptance:
    1. Final Acceptance of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a 90-day test period without any unwarranted or false alarms. Should an unwarranted or false alarm occur, the contractor shall readjust or replace the faulty component and begin another 90-day test period. As required by the Architect/Engineer, the contractor shall recheck and retest the replaced components after each readjustment or replacement. This test shall not start until the owner has obtained beneficial use of the building under test.
    2. Before final acceptance of work, the contractor shall deliver five copies of a composite "Operating and Shop Maintenance Manual". Each manual shall contain a statement of guarantee including date of termination and name and phone number of the person to be called in the event of equipment failure, including individual factory issued manuals containing all technical information on each piece of equipment installed. In the event such manuals are not obtainable from the factory it shall be the responsibility of the contractor to compile and include them. Advertising brochures or operational instructions shall not be used it lieu of the required technical manuals.
- Training:
    1. Training shall be included in the testing phase of the system installation. The manufacturer's technician shall instruct the University personnel in all aspects of the system. The manufacturer's technician shall be available to answer all questions and provide explanations as requested by the University personnel.
    2. Provide three, three-hour training sessions, with one session per day for three consecutive days, for campus Electrical Department personnel. Also, provide one four-hour session of training in operation and maintenance. Training times indicated are actual times exclusive of travel.

275000 DISTRIBUTED COMMUNICATIONS AND MONITORING SYSTEMS

- Coordinate with the UIC Campus Police Department.

275313 CLOCK SYSTEMS

- Simplex 6351 Master Clock is preferred.

BUILDING STANDARDS

DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY

280000 ELECTRONIC SAFETY & SECURITY

- Coordinate with the UIC Police Department.
- See the Telecommunication Standard for Security Cabling Requirements: http://www.uic.edu/depts/accc/telecom/ted.html
- Exit Signs:
    1. Combo units shall be used where battery back up lights are required.

283000 ELECTRONIC DETECTION AND ALARM

- All fire alarm raceway, conduits, junction boxes, and terminal boxes shall be of red color or shall be painted red.

283100 FIRE DETECTION AND ALARM

- Fire Alarm System Design Standards:
    1. General:
        a. New fire alarm systems and extension/modification of existing systems shall be in accordance with the provisions of most current City of Chicago Fire Prevention Code and shall comply with NFPA 72, 1997 edition and related NFPA requirements. The system's wiring and conduit design shall conform to more stringent of National and City of Chicago Electrical Codes. Design of all Fire Alarm systems shall be submitted to Authority Having Jurisdiction (AHJ) for review and approval. The University will identify AHJ. The University will make available the as-built drawings of the fire alarm systems that it has in its archives, however, it shall be the designer's responsibility to field survey the fire alarm system of the building where renovation/remodeling is being contemplated, to ascertain the spare and expansion capability of the existing fire alarm system. Additionally the fire alarm system shall conform with the Americans with Disabilities Act
        b. Fire alarm design drawings shall indicate, at the minimum, the location of devices, their heights, size of wires, conduit, zones, location of risers, and spare capacities of audio and visual circuits. Designer shall obtain the approval of his design from the AJH before release documents for bids.
    2. New Systems:
        a. The University will establish Code Occupancy for designers. In case of disagreement the designers shall discuss it with the Office for Capital Programs (OCP). New systems, in general, shall be addressable, voice communication systems, unless it is unsuitable or unacceptable by applicable code or AHJ. Fire alarm design drawings shall conform to the requirements of AHJ's drawing review requirements. Fire alarm systems shall be zoned and its risers shall be protected with appropriate enclosures. Zones shall be designed with a minimum of 10% future expansion capacity. The bid documents shall require the installer to identify the wire according to the zone they serve by Brady tags at each terminal point. The visual loops and audio alarming circuits shall be designed to provide a minimum of 20% spare capacities.
        b. The fire alarm control panels shall be specified to be capable of providing an alarm and a trouble signal to Catalog No. 95M3086-1 TTM (Tones Transmitter Module), manufactured by Keltron Corporation, Waltham, MA 02154.
    3. Buildings with Existing City Approved Fire Alarm Systems:
        a. With the exception of a few, all campus buildings with accommodations at any one time of more than 100 students have been classified as C3 Type II Schools and are currently equipped with City approved Class I fire alarm systems and have the City tie. Any modification(s) to such fire alarm systems shall be designed and installed only after review and approval of the City of Chicago Bureau of Fire Prevention.
        b. Additionally, buildings such as the University of Illinois Hospital (UIH), the Eye and Ear Infirmary (EEI), Health and Human Development Sciences Building (HHDSB) have City Tie.
    4. Existing Buildings that have a Non-Code Compliant Fire Alarm System:
        a. The campus has buildings that have fire alarm systems that do not conform to City approved Class I fire alarm system requirements. University will identify such buildings to the designers. In such

buildings, any major renovation project shall include the total upgrade of the building's fire alarm system.

5. High Rise Buildings with Non Compliant Fire Alarm Systems:
    a. The scope of major renovations in buildings of 80 feet or more above grade shall include installation of a new addressable, voice communication, City of Chicago Approved, High Rise fire alarm system.
6. Approved Manufacturer's of Fire Alarm Control Panels:
    a. Limit the approved manufacturers to 3 or 4 manufacturers. Specify manufacturers that will be in business for a reasonably foreseeable length of time. Specify manufacturers that will provide to UIC electricians the training and authority to deactivate selective zones, detecting device(s), alarming device(s); and the ability to program new devices. Specify manufacturers that have good track record with respect to providing technical services or parts to the University. The University will identify manufacturers whose performance had been less than satisfactory.
    b. As much as possible specify manufacturers whose control panels can accommodate detecting devices of other approved manufacturers as well.
7. Deactivation of Portion(s) of Existing Fire Alarm Systems:
    a. The Designer of remodeling projects, shall identify the zone(s) or loops of an existing operational fire alarm system, required to be temporarily deactivated for purposes of adding new devices or relocating existing devices.
    b. The Designer shall identify the zones or addressable loops that will be partially or fully required to be demolished so that the remaining fire alarm system of the building will be operational all the time. This may involve relocating the end of line resister.
8. Owner's Manuals and Parts List:
    a. Vendor/manufacturer shall provide the programming code and password to the University. The University shall have full access to program, diagnostic and maintenance of the entire system.
    b. Provide language in contract documents to the effect that contractor prior to demonstration of satisfactory operation of new fire alarm system or new devices, shall submit 3 sets of owner's manuals and parts list of the installed fire alarm system.
9. Testing:
    a. Acceptance of fire alarm system shall be contingent upon
        i. demonstration by installer to UIC Electrical Department that every device and equipment of the fire alarm system is performing in accordance with specifications and approved shop drawings, UIC electrical Department receiving 3 sets each of approved shop drawings, equipment brochures and owners manuals,
        ii. UIC electricians receiving training on trouble shooting,programming and servicing.
    b. The Designer shall specify that after completion of the fire alarm system, the installer shall himself test all devices and shall be required to certify in writing that he has satisfactorily tested all devices, the annunciator and the control panel, and he is ready to demonstrate the system to the University. The OCP Project Manager, in consultation with UIC Electrical Department, will schedule the fire alarm test.
    c. The installer will provide sufficient manpower to demonstrate the satisfactory operation of all devices to UIC electrical department.
10. Symbols:
    a. For standardization all fire alarm symbols shall be the City of Chicago Fire Alarm Symbols.
11. In case of building fire all stair doors shall automatically unlock to allow people not to be trapped in the staircase.

BUILDING STANDARDS

DIVISION 31 -- EARTHWORK

310000 EARTHWORK

- Existing topsoil shall be stripped and stockpiled separately from other soil for use in finish grading. Surplus topsoil shall be delivered to Grounds storage yard.
- Excavate subsoil and stockpile for reuse. Remove excess from site.
    1. Unless otherwise directed by the University, other surplus excavated material not of topsoil quality shall become the property of the contractor and shall be legally disposed of by the contractor outside University property.
    2. In the event that surplus earth not of topsoil quality is to be disposed of on University property, the specifications should indicate the maximum hauling distance plus control and grading provisions related to the on-campus disposal area. Contractors should be required to level or stockpile the dirt so that access for additional storage or for other purposes is maintained.
- No topsoil shall be spread on sub-grade until the sub grade preparation has been approved by the A/E.
- Topsoil should be spread to a minimum of 12 inch thickness for lawn areas and 24 inches for planting beds with a tolerance of plus or minus 1 inch.

311000 SITE CLEARING

- All utility outages must be scheduled in advance so as not to interfere with University operations. The University must be notified at least two (2) weeks prior to removal of any work connected to utilities so that arrangements can be made for proper disconnection of such utilities.
- The A/E and the University's Representative will walk the project site to identify plant material to be removed or preserved. Material designated for preservation shall be shown on the contract documents to be protected by the designated contractor before performing any work on site.
- Existing valve boxes and manholes should be protected so they will not be crushed, buried with earth or covered with construction material and made inaccessible.
- Trees, shrubs and groundcover:
    1. Existing trees, shrubs and groundcover to be saved are to be protected from project work out to their drip lines. Trees shall be fenced with 6 foot high protective fencing installed in the ground to avoid trespass while shrubs shall be protected from falling debris. If plant material must be removed for the project, removal must be approved by the University.
    2. Trees immediately adjacent to any work shall have their limbs tied back for clearance. Contractor shall notify the University if pruning is needed for clearance before such pruning is done. Contractor to provide licensed arborist to perform all required pruning.
    3. Vehicles, equipment, and materials are not to be stored under drip lines. Travel under drip lines is not permitted except as necessary to perform the work. Travel under drip lines shall be allowed only with root protection conditions: Protect from root compaction, protect sail within drip line from compaction.
    4. Damage to plant material, either by removal, injury, or excessive pruning will for assessed for value loss and will be accountable by the contractor for the project. The "Guide for Establishing Values of Trees and Other Plants" by the International Society of Arboriculture, latest edition, will be used to establish such value. Any costs of repairs and replacements will be the sole responsibility of the contractor.

BUILDING STANDARDS

DIVISION 32 -- EXTERIOR IMPROVEMENTS

321216 ASPHALT PAVING

- Do not locate dumpsters on asphalt.
- Asphalt will not be allowed at truck docks

321313 CONCRETE PAVEMENT

- Maintain access for vehicular and pedestrian traffic as required by the University.
- Provide concrete pavement under all dumpsters.
- Concrete pavement at loading docks to extend to the drive wheels of truck.
- Sidewalks shall be minimum 5" thick with broom finish
- Provide ADA compliant 'raised cast cone pattern' at ramps per City of Chicago.
- Provide control joints at in all sidewalks at 6' on center.

321400 UNIT PAVING

- Use only manufactured precast stock paver units and accessories.
- Paver Type 1 for installation as field application to be 4" x 8" x 2-3/8".
- Paver Type 2 for installation as border to the field application to be two rows of 4" x 8" x 2-3/8" with a false joint detail with the 4" x 4" look.
- The West Campus paver blend shall be a red/brown/charcoal range, also known as range 1.
- East Campus paver blend shall be a charcoal brown/buff range, also known as sierra.

323119 DECORATIVE METAL FENCES AND GATES

- The University Standard fence is ornamental iron. See UIC Project Manager for details.
- The University Standard pedestrian control device is the post and chain. See UIC Project Manager for details.
- See UIC Project Manager for CAD drawings containing fence and gate detailed specifications.

328000 IRRIGATION

- Actual installed conditions are to be recorded by the Irrigation Contractor in the form of an "As-Built Drawing". As-Built Drawing shall be clearly and neatly drawn on a base of the original landscape design provided by the Landscape Architect. Provide the University and Landscape Architect with a copy of the As-Built Drawing. Provide the University and the Landscape Architect with a copy of the As-Built Drawing before Work under Contract will be considered for Acceptance. All automatic and manual valves, hose bibbs or quick couplers, and wire splice locations shall be shown with actual dimensions to reference points so they may be located easily in the field. Submittals of the approved As-Built Drawing will precede any Application for Final Payment by the Contractor.
- Warranty all Work for a period of one (1) year, starting on Project Acceptance, against defects in materials, equipment, workmanship, and any repairs required resulting from leaks or other defects of workmanship, material, or equipment. Emergency repairs may be made by the University, General Contractor, or Landscape Contractor, as appropriate, without relieving the Irrigation Contractor of any warranty obligations.
- Main line pipe to zone valves to be PVC CL-200, 200 PSI rated. Lateral pipe to sprinkler heads to be PVC CL-160, 160 PSI rated. Shall be supplied in standard twenty (20) foot lengths and shall be from one of the following preferred manufacturers:
    1. Certainteed Corporation.
    2. Crestline.
    3. Dura.

  All pipe that is exposed or not below grade shall be Schedule 80 PVC. Provide sleeves below all sidewalks and embedded brass survey tack. Sleeves to extend 12" beyond walks.
- Electric Wiring:
    1. 120 volt service to controller shall consist of three wires: one black, one white, and one ground. Electrical service is to be provided by the General Contractor unless otherwise directed by the University.
    2. Splices in controller wiring shall be waterproof using 3M-DBY wire connectors.
    3. Control Wiring shall be 24 volt solid wire Underwriter's Laboratory (UL) approved for direct burial in ground. Minimum wire size shall be fourteen (14) gauge. All control wiring and wiring connections from the controller to the valves is included in this Contract.
- Sprinkler Heads:
    1. Fixed Spray Sprinkler Head: Sprinkler shall be of the fixed spray type designed for in - ground installation. Sprinkler shall be capable of covering a maximum of fifteen (15) foot radius at thirty (30) psi and maximum delivery of four (4.0) gpm.

a. Nozzle shall be comprised of one (1) or more orifices at two (2) radius ranges and shall be adjustable from fully on to fully off. Retraction shall be achieved by a heavy duty stainless steel spring. Nozzle piston shall have a smooth external surface operation in a resilient guide. Riser wiper shall be included in the sprinkler for continuous operation in the presence of sand and other foreign material.
b. Coverage shall be full or part circle. Part circle coverage shall be available in arcs of 90, 120, 180, 240, and 270 degrees or adjustable part circle. A centerstrip head shall also be included for coverage. Nozzle delivery shall allow circle patterns to match full circle patterns in precipitation rates.
c. The body of the sprinkler shall be constructed of non - corrosive heavy duty Cycolac. A filter screen shall be in the nozzle piston. All sprinkler parts shall be removable through the top of the unit by removal of a threaded cap.

2. Preferred manufacturer:
   a. Nelson Co.
   b. Rainbird Sprinkler Mfg. Co.
   c. Toro Co.

- Automatic Controller:
  1. Controller location must be easily accessible for maintenance. Provide for the possibility of making minor timing adjustments to the controller in the field.
  2. Provide electromechanical controllers capable of fully automatic as well as manual operation of the system. Controller housing is to be a wall mounted, weatherproof, lockable cabinet.
  3. Provide controller which operates on a minimum of 110 volts AC power input and is capable of operating 24 volt AC electric remote control valves, with a reset circuit breaker to protect from overload. Irrigation Contractor is responsible for connection of 120 VAC power to controller.
  4. Each station shall have a time setting knob which can be set for variable timing in increments from six (6) to sixty (60) minutes, or set to omit the station from the irrigation cycle.
  5. Controller shall have a fourteen (14) day calendar dial with captive three position pins for setting the programmed start days, and a twenty - four (24) hour clock dial with twenty-three (23) captive hour pins for programming the irrigation cycle start time. A master "on - off" switch shall allow the valve power output to be interrupted without affecting the controller.
  6. Controller must be constructed so that all internal parts are accessible through the controller door without disturbing the cabinet installation.
  7. Preferred manufacturer:
     a. Rainbird Sprinkler Mfg. Co.
     b. Superior
     c. Toro Co.
- Backflow Preventer
  1. To be supplied and installed by the Irrigation Contractor. Backflow preventer shall be a RPZ reduced pressure backflow assembly type, capable of having an adequate flow rate in gallons per minute (gpm) without excessive pressure loss, and shall be suitable for supply pressure up to 150 psi. Backflow preventer body shall be bronze, internal parts shall be stainless steel, and the check valve assemblies shall be tight seating rubber. Backflow preventer assembly must include two (2) gate valves for isolating unit, and two (2) ball valve test cocks for testing unit to ensure proper operation. Backflow preventer(s) shall comply with requirements of local codes, ordinances, and regulations.
  2. Preferred manufacturer:
     a. Cla-Val Co.
     b. Febco.
     c. Hersey Products Inc.
     d. Watts Regulator Co.
     e. Wilkins Regulator.
- Quick Coupling Valves:
  1. Quick Coupling Valves (QCVs) will be used for manual access to the pressurized main line so that a hose can be attached and used for hand watering. QCVs shall be constructed of brass with a spring loaded seal that will keep the valve in a closed position until the key is inserted into the valve. Valve shall also have a hinged aluminum cap to prevent any debris getting into the internal mechanism of the valve. QCVs shall be installed on a triple elbow swing joint.
  2. QCV keys shall be of the single lug variety. Attached to the key will be a hose swivel adapter sized to the hose commonly used on the project. Irrigation Contractor to contact the University's maintenance personnel to determine hose type. Key and swivel shall both be constructed of brass.
  3. Preferred manufacturer:
     a. Rainbird Sprinkler Mfg. Co.
     b. Weather-matic Sprinkler Div., Telsco Industries.
     c. Toro Co.
- Control Valves:
  1. Provide Electric Remote Control Valve that conform to Manufacturer's

specifications concerning performance at given pressures.
2. Preferred manufacturer:
    a. Rainbird Sprinkler Mfg. Co.
    b. Superior
    c. Toro Co.

- Flag all existing underground utilities prior to trenching and/or boring operations. Obtain locations of any new utilities from the University and/or the General Contractor. Irrigation Contractor is solely responsible for contacting the utility locating service(s) and locating on - site utilities in advance of installation.
- Prior to trenching and excavation remove sod, preserve, and replace after backfilling is completed. Trenching and excavation in established grass or newly seeded areas: Re-grade trenched area consistent with surrounding area and reseed with grass seed matching existing grass or seed. Mulch seed after broadcasting. Cutting, removal, and replacement of asphalt is the responsibility of the Irrigation Contractor.
- Irrigation Contractor shall spray paint on the ground all proposed trenching or excavation which occurs within the drip line or within fifty (50) feet of the trunks of existing trees, whichever is greater. Irrigation Contractor must contact the Landscape Architect for review of the proposed trenching and excavation lines prior to proceeding with the work. Landscape Architect may adjust proposed trenching and excavation lines in order to avoid damage to tree root systems and other plants. Such adjustments shall be made by the Irrigation Contractor at no additional cost to the University.
- Upon completion of the Work and final acceptance by the University and the Landscape Architect, the Irrigation Contractor shall be responsible for the orientation of maintenance personnel in the operation, maintenance, and repair of the system. Furnish copies of all available parts lists, trouble shooting lists, and specification sheets to the University prior to final payment.
- In the fall of the year of Final Acceptance, the Contractor shall be responsible for winterizing the system. Irrigation piping must be winterized by blowing the system clear of water using compressed air (eighty (80) psi maximum) admitted into the piping at a quick coupling valve or hose bib located at a higher elevation on the system piping. Activate individual zones, higher zones first, then proceed successively through the system towards lower elevations. Proceed through all zones twice. The air compressor used to winterize the system must have an engine separate from the compressor tanks to prevent high temperature air from being injected directly into the PVC piping. The University staff must be present at the time of the winterizing.
- In the spring following Final Acceptance, the Contractor shall be responsible for starting up the system. The University staff must be present at the time of the start up.

329000 PLANTING

329200 TURF AND GRASSES

- Contractor shall furnish all hoses, meters, back-flow preventers, and any other connections necessary to carry out watering needs. Provide six (6) month maintenance agreement during growing season/cycle.
- Maintain a minimum of one foot of topsoil. Topsoil shall not be used while in a frozen or muddy condition. Surplus materials shall be disposed of by the contractor.
- Scarify compacted areas to an 18 inch depth. Scarify compacted subsoil before topsoil is added. Work the soil down to pea sized particles and form an appropriate grade that will allow the sod to be just below flush with paved areas or as required for seeded areas.
- Roll the area with an appropriate sized roller used in landscaping to firm the sod bed, then re-level to the appropriate grade.
- Sod Installation:
    1. Sod shall be properly moist at the time of cutting and shall be laid within 24 hours of cutting to prevent excessive heat buildup.
        a. Roll sod for good soil contact making only one pass.
        b. Water thoroughly until subsoil is wet and whenever sod shows signs of drying or wilting. Sprinklers or nozzled hoses are acceptable. Continue watering until the project is accepted.
        c. Fertilize immediately prior to sodding or immediately after the sodding operation at a rate of .5 pounds of nitrogen per 1000 square feet.
        d. Work is to be done at typically accepted sodding times in spring or fall when temperatures are mild and establishment can be completed.
        e. Maintain lawn until project is accepted or a minimum of thirty (30) days after installation, including watering, weeding, re-seeding or re-sodding, mowing, trimming, and edging. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
        f. Sodding operations shall be repeated until a satisfactory uniform stand of grass is obtained as determined by the A/E. Damage resulting from erosion, washouts, drought, diseases, or other causes shall be repaired by filling with topsoil, tamping, fertilizing,

and sodding by the contractor at no additional compensation.

- Seeding Operation:
  1. Rake seed for good soil contact.
  2. Water with sprinklers whenever soil surface is dry and until small puddles just begin to form. Open-ended or nozzled hoses will not be accepted. Continue proper watering schedule until the project is accepted.
  3. Fertilize immediately prior to seeding or immediately after seeding at a rate of .5 pounds of nitrogen per 1000 square feet.
  4. Work is to be done between April 15 and May 31 or August 15 and October 15 when temperatures are mild and establishment can be completed.
  5. Maintain lawn for a minimum of ninety (90) days or until project is accepted after installation, including watering, weeding, re-seeding or re-sodding, mowing, trimming, and edging. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
  6. Seeding operations shall be repeated until a satisfactory uniform stand of grass is obtained as determined by the A/E. Damage resulting from erosion, washouts, or other causes shall be repaired by filling with topsoil, tamping, fertilizing, and seeding by the contractor at no additional compensation.

329300 EXTERIOR PLANTS

- Plant selection and tagging:
  1. Plants shall be subject to inspection and approval at their place of growth and upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. A contractor's representative shall be present at all inspections.
  2. Written requests for inspection of plant material at their place of growth shall be submitted to the University's Representative at least 10 calendar days prior to digging. Written requests shall state the place of growth and quantity of plants to be inspected. The University's Representative may refuse inspection at this time if, in his judgment, a sufficient quantity of plants are not available for inspection.
  3. Plants identified as "selected specimen" shall be approved and tagged at their place of growth. For distant material, submit photographs for pre-inspection review.
  4. Trees are to be a minimum three-inch (3") caliper.
- Digging and handling of plant material:
  1. Ball and burlap (B&B) plants shall have natural balls of earth, of size not less than that recommended in the "American Standard for Nursery Stock". Plants moved with a ball will not be accepted if the ball is dry, cracked, or broken before or during planting operations.
  2. All plants shall be freshly dug. Heeled-in plants or plants from cold storage will not be accepted. All nursery grown plants shall have been transplanted or root pruned at least once in the last three years.
  3. All plants shall be handled so that the roots, trunk, and branches are adequately protected at all times. During shipment all plants shall be properly protected by a shade tarpaulin of approximately 90% shade material. No plant shall be so bound with rope or wire at any time as to damage the bark, break branches, or destroy its natural shape.
- Plants:
  1. Plants shall be true to species and variety specified and nursery grown in accordance with good horticultural practice under climatic conditions similar to those in the locality of the project for at least two years. Plants shall be freshly dug, unless specified as container stock, and shall not be in leaf at time of digging.
  2. Unless specifically noted otherwise, all plants shall be of specimen quality, exceptionally heavy, symmetrical, so trained or favored in development and appearance as to be unquestionably and outstandingly superior in form, compactness, and symmetry. They shall be sound, healthy, vigorous, well branched and densely foliated when in leaf, free of disease, insects, eggs, or larvae and shall have healthy, well developed root systems.
  3. Plants shall not be pruned before delivery. Trees with multiple leaders, unless specified, will be rejected. Trees with a damaged or crooked leader, abrasion of bark, sun scald, disfiguring knots, insect damage, or cuts of limbs over 3/4 inch in diameter rot completely callused will be rejected.
  4. All plants shall conform to the measurements specified in the plant list and shall conform to the "American Standards for Nursery Stock". Plants larger than specified may be used if approved by the University's Representative. Use of such plants shall not increase the contract price. If larger plants are approved, the root ball shall be increased in proportion to the size of the plant.
  5. All plants and all tree trunks shall be measured when the branches are in their normal position. Dimensions for height and spread refer to the main body of the plant and not from branch tip to branch tip. Measurements specified are minimum size acceptable after pruning where pruning is required. Plants that meet requirements but do not possess a normal balance between height and

spread shall be rejected.

6. All plants shall be labeled with correct plant name and size. Labels shall be securely attached to all plants, bundles, and containers of plant materials delivered.
7. Substitutions of plant materials will not be permitted unless authorized in writing. If proof is submitted, substantiated in writing, that any plant specified is not obtainable, a proposal will be considered for the use of the nearest available size or similar variety with a corresponding adjustment of the contract price.
8. When the plant list is completed, it will include what was removed and/or damaged beyond reasonable repair during the project, their correct spacing, and type (ball and burlap, container, etc.). Any damage will be evaluated by the University's Representative as to whether replacement is necessary. Such replacement shall be the sole responsibility of the contractor.

- Mulch:
  1. Mulch will be shredded hardwood bark, chemically inert, nontoxic, free of weeds or any other substance injurious to plant growth. Shredded bark will have a uniform fibrous texture free from cakes and lumps. It will be free of foreign material and of a uniform color. No individual piece will be larger than 2 square inches.
- Excavating of planted areas:
  1. Where required for planting operation, the contractor shall perform all necessary excavations as part of the contract price. Stake out plant locations and obtain approval of the University's Representative before excavation is begun. Excavations shall include all rock, old concrete, earth excavations. The contractor shall be responsible for locating all underground utilities, and take all necessary precautions not to disturb or damage these utilities.
  2. When an obstruction of rock, tree roots, utilities or any other object of substantial size and extent is encountered, an alternate location for the plant may be selected by the University's Representative. Where locations cannot be changed as determined by Facilities Management representatives, submit cost required to move or remove the obstruction. Proceed with such revisions only after approval by University's Representative.
  3. Excavations shall be scheduled so that it will be followed immediately by the placement of plant materials and during the specified planting season.
  4. Excavate tree pits to the depth of the tree ball and at least twice the width of the tree ball. Excavate shrub pits to depth of shrub ball or container and one foot wider than the ball or container. Excavate groundcover pits to depth of container or sufficient to plant bare root groundcover to appropriate depth. Depth of all plant pits specified will be measured from the finish grade.
  5. Detrimental soil conditions affecting plant growth shall be reported in writing to University's Representative. State condition and submit proposal of correcting the condition to University's Representative. Proper drainage must be assured.
  6. All excess excavated materials shall be disposed off site by the contractor. The contractor shall be responsible for removing all rubbish, waste materials, or other debris from the site at the completion of each working day.
- Planting operations:
  1. Protect plants at all times from conditions detrimental to the health of the plants. Plants that cannot be planted immediately on delivery shall be kept in shade or sun, according to their specific requirements, with B&B material well protected with soil, wood chips, shredded bark or other acceptable material, and shall be kept watered. Plants shall not remain unplanted for longer than three (3) days after delivery.
  2. Set plants in planting pits at same relationship to finished grade as they were to the ground from which they were dug. Set plant plumb and brace rigidly into position until prepared topsoil has been tamped solidly around ball and roots so that the plant will be of the same depth one year later. See "Tree and Shrub Transplanting Manual".
  3. Cut and remove ropes, strings and wrapping from the top one-half of the ball after plant has been set. Leave balance of wrapping intact around the ball. All waterproof, water repellant, or rot resistant wrappings shall be removed from the ball. Wire baskets shall be removed if the ball will hold together once it is removed.
  4. Backfill plant pits with excavated material. When plant pits have been backfilled about one-half full, water thoroughly, eliminating all air pockets.
  5. After watering, install soil to top of pit and repeat watering. Avoid puddled soil conditions.
  6. Form saucer around tree and shrub pits as indicated in the "Tree and Shrub Transplanting Manual".
  7. Firm soil around groundcover plants and water thoroughly.
  8. Finish grade the planting area to conform to appropriate grade after full settlement of the soil has occurred.
  9. Mulch all pits with shredded bark to a depth of 3 inches immediately after planting.
  10. Water all plants thoroughly. Water will be furnished to the contractor by the owner from existing facilities. Contractor shall furnish all hose, meters, back-flow preventers and other connections necessary for watering plants.

- Guying, staking, wrapping and pruning:
    1. Flag guys with 18 inch sections of 1 inch diameter white PVC pipe, if guys extend outside planting area or pose a tripping hazard, shall be completed immediately after planting. Drive anchors into the ground outside of the planting pit to a depth that will securely hold the tree. Attach cables with hose around the trunk. Leave cables with just enough slack that they will go tight in a wind.
    2. Use three stakes on trees.
    3. Wrap trunks of deciduous trees 1.5 inches or more in caliper with a spiral overlapping tree wrap to a minimum height of the first branch. Wrap from the bottom and tie wrapping securely in place. Consult University's Representative for acceptance trunk wrap material.
    4. Prune plants only at time of planting and according to horticultural standards to preserve the natural character of the plant, and only to remove broken, crossing, or damaged branches. Pruning is to be done only with approval of University's Representative. Use only clean, sharp tools.
- Maintenance of trees, shrubs and groundcovers.
    1. Maintenance shall begin immediately after each plant is planted and shall continue until acceptance.
    2. Maintenance shall consist of pruning, watering, cultivating, weeding, mulching, tightening, repairing of guys and stakes, wrapping repair, resetting plants to proper grades or upright condition, restoration of planting saucer, and furnishing and applying such sprays or other items as are necessary to keep the plantings free of insects and disease and in thriving condition.
    3. Sidewalks and other paved areas shall be kept clean of debris and material resulting from planting and maintenance work.
- Pruning:
    1. Pruning of existing plant material shall be done only with approval of University's Representative. Each plant shall be pruned to preserve its natural character and according to accepted standards. Prune with sharp tools only. Make cuts flush and clean.
- Fertilizing:
    1. Commercial fertilizer for trees and shrubs shall be Nutri-Pak controlled release plant food as manufactured by JRP International, Inc. of Fon du Lac, Wisconsin or Owner's Representative approved equal.
        a. Standard formulation: Guaranteed analysis of 16% total Nitrogen, 8% available Phosphoric Acid and 8% soluble Potash (16/8/8) packaged in a patented controlled release packet.
    2. Commercial fertilizer for groundcover and perennials shall be a general purpose complete plant food (10-10-10), furnished in a uniform granular or pelletized form as approved by Owner's Representative.
        a. Standard formulation: Guaranteed Analysis of 10% total Nitrogen, 10% available Phosphoric Acid and 10% soluble Potash
- Guarantee
    1. The guarantee period for trees, shrubs and groundcovers shall begin at the date of the Substantial Completion.
    2. All plant material shall be guaranteed by the contractor for a period of one year from the date of Substantial Completion to be in good, healthy, and flourishing condition.
    3. The contractor shall further guarantee that during the period of the guarantee he will make good any defects to the work and all damage caused to property of the owner by such defects or by the work required to remedy such defects.
    4. At any time within the period of the guarantee, the contractor shall be responsible for any plant which is dead, dying, in a declining condition, or which has failed to flourish in such a manner or in such a degree that its usefulness or appearance has been impaired due to inferior or defective materials or workmanship or inadequate protection. The decision of University's Representative for making replacements shall be conclusive and binding upon the contractor. The contractor shall also make good all damage to persons or property caused by defective workmanship or materials.
    5. Any trees or shrubs found to be unacceptable as described above shall be removed from the site and replaced during the next planting season.
    6. Plant replacements shall be of the same kind and size as specified in the plant list. All plant replacements shall be inspected, furnished, planted, mulched, and otherwise installed as specified at the contractor's expense.
    7. Where plants are replaced, the contractor shall be responsible for repairing any damage caused by this replacement to lawns, pavements, or other areas involved with the replacement.
    8. During the guarantee period, the contractor shall, from time to time, inspect the watering, cultivation, and other maintenance operations carried on by the owner or its agents with respect to such work and promptly report to the owner any methods, practices, or operations which he considers unsatisfactory, and not in accord with his interests or good horticultural practices. The failure of the contractor to so inspect or report shall be construed as an acceptance by him of the owner's maintenance operations; and he shall not thereafter claim or assert that any defects which may later develop are the results of such methods, practices, or operations. The

contractor shall have the opportunity, together with the owner, to establish the maintenance program to be followed.

BUILDING STANDARDS

DIVISION 33 -- UTILITIES

330513 MANHOLES AND STRUCTURES

- Castings shall conform to the requirements of grey iron castings ASTM A 48 and conform to the details shown on the drawings. Lids shall have the word "UIC ELECTRIC" cast into lid.

331000 WATER UTILITIES

- All water systems and services are installed by the City of Chicago.

  Note: Since alternate methods of extension or repairs are available for various portions of the work, it will be necessary to actually specify materials and methods and not to state that this document is by reference made a part of the specification and contract, or that the work is to be provided and installed in accordance with requirements of this document. New sections of water main, including fire hydrants which actually become a part of the grid system of distribution, will generally be constructed under a separate contract. The branch service connection to building, including extensions to the main and fire hydrants where required for each particular building, shall be included in the building contract unless otherwise directed by the University.
- Fire hydrants design shall be compatible with M&H, Clow, or Waterous hydrants since repair parts for these hydrants are maintained as stock by the University.

  1. Backfilling: Contractor shall obtain A/E, Facilities Management and City of Chicago approval of installation of water mains before any section is covered. Backfilling for water mains shall be specified, with particular attention given to backfilling under water mains, including the removal of previously disturbed earth outside of foundation walls, and replacing of same with sand or pit-run gravel thoroughly compacted, so as to provide a firm bed for the main at all such points.
  2. Install the domestic water system above the sanitary system when in conflict, or as mandated by code.

334600 SUBDRAINAGE

- Provide footing drains and areaway drains around exterior of the building.
- Where conditions so require, provide subsoil drains under floor slabs inside the building and under tunnel floors to prevent seepage of ground water into the building.
- Drain lines should be extended to a sump and pumped to a storm sewer manhole if gravity flow is not possible. If discharge is by gravity flow, suitable means shall be provided to prevent backflow due to overloaded sewer lines.
- Provide underdrains for swales and lawn areas with less than a 2% surface slope and under new trees, planting islands in parking lots, and any planting.
- All trees, shrubs, and planting beds shall be tiled with 4 inch plastic drain tile that is wrapped with drainage fabric. The top of tile is to be placed at a depth of 36 inches below finish grade. If conditions do not permit tile installation at a 36 inch depth, a 24 inch minimum depth is permitted after approval by the University. Coordinate underground utilities and ductbanks for proper depth.
- Area wells, stairwells and access ramps below grade are not allowed unless approved by the University in writing.

334900 STORM DRAINAGE STRUCTURES

- Sewers shall be run from each building and be connected to the proper City system. Sewers shall receive drainage from roof, yard, footing and underslab tile, and curb drains only. Consult with the City of Chicago Department of Sewers for detention requirements. Yard and curb drains may be constructed without basin seals. Subsoil drainage in major projects shall be provided with separate duplex bilge pump unit and discharged to sewer system.
- On University projects: Gain approval prior to the bidding procedure from the appropriate City of Chicago, and the University for the design and method of discharge and connection to existing sewers.
- Abandoned manholes and catch basins shall be removed to 2 feet below grade and filled with washed sand or gravel. All openings in abandoned manholes shall be plugged with concrete and brick. Exterior downspouts shall be provided with cast iron leader boots and cast iron pipe to bridge excavation trench along walls. Anchor boots to wall and caulk downspouts with mastic so as to allow expansion movement.
- Maximum spacing between manholes shall be approximately 300 to 400 feet, unless a waiver is requested, reviewed and approved by the University.
- Sewer wyes must be of the same material as the main-line piping.
- Saddles will only be allowed if the main line piping has a 12 inch diameter or greater. If a connection is to be made where there is no wye and the piping is smaller than 12 inches, a section of pipe shall be removed and a wye inserted with mission couplings and new sections of pipe as needed.

- Backfill of trenches under paved areas and within 2'-0" of the edge of any pavements the sewer trench must be backfilled with CA-6 trench backfill placed in 12 inch lifts and compacted to 95% of the standard Proctor unless flowable fill is used, in which case the fill shall be designed to have a compressive strength between 100 to 150 psi.
- All main lines must be capable of transmitting light between manholes. If the light cannot be seen, the sewer must be capable of passing a two-foot cylinder, which has a diameter 1 inch less than the inside diameter of the pipe being tested.
- All pavement and sidewalks are to be replaced to their original thickness, material type or types, and grade except where the old pavement was deficient, which then must be brought up to current standards.
- Do not locate catch basins within landscaped areas without the written permission of the University.
- Storm drains intake in parking lots to be in line with curb.
- Reinforce curbs over storm lines.

336300 STEAM ENERGY DISTRIBUTION

- Steam for space cooling and domestic water heating for use in buildings will be supplied by steam generated at the Medical Center Steam plant/Co-generation Facility. Steam is generated at a pressure of 140 psig saturated with a superheat of approximately 50 degrees. Distribution is via steam tunnel, shallow tunnel or direct buried pipe. All steam piping shall be schedule 40 carbon steel pipe. All condensate return piping shall be schedule 80 carbon steel pipe. All joints shall be welded. No flanged fittings shall be allowed. The University Office for Capital Programs should be consulted in each case for availability and approval.
- Condensate from all uses within a building must be discharged using steam powered condensate pumps at the building into a pressure return main against a head of not less than 50 psig Any underground high pressure steam line must be trapped and traps are to be accessible in a steam pit with removable cover. Any high pressure traps discharging into a condensate return line must have velocity eliminators in the line to prevent hammering and potential damage to the condensate return line. Traps shall be inverted bucket design. Consult with The University Office for Capital Programs regarding specific discharge pressure for each project.
- In the event the underground steam service is not designed by the consulting engineers for the steam distribution system, the following standards will be applicable to the associate architects:
    1. Sketches and preliminary specification data pertaining to the branch connections to tunnels and tunnel mains must be presented to the University for reviews as soon as possible in order that such designs may be reviewed and approved by The University Office for Capital Programs.
    2. The design of the underground steam service is not to be incorporated in the working drawings and specifications until such preliminary sketches and specifications have been approved by The University Office for Capital Programs.
- Installation of steam and condensate piping to buildings shall be in concrete shallow or deep tunnels. The shallow tunnels shall be provided with accessible-removable covers and may be installed so that the top of the tunnel is at grade or in a subsurface configuration. Tunnel to be completely drainable.
- Direct buried conduit system use must first be approved by the University and, if allowed, shall have an outer 10 gauge minimum steel outer conduit of welded construction with Factory applied polyurethane foam, having a density of 2.0 to 3.0 pounds per cubic foot. The insulation thickness shall be a minimum of 1 inch thick. The outer jacket shall be high density polyethylene or fiberglass with a minimum thickness of 150 mils. Outer conduit shall be tested at 15 psig air pressure for at least four (4) hours. Inner steam pipe shall be schedule 40 carbon steel. Condensate pipe shall be schedule 80 carbon steel.
- All welded joints on the inner pipe shall be sealed with a chromate heat and rust resistant paint and sectional insulation applied before the outer casing is assembled. Joints in the inner pipe of 2 inch size and smaller shall be of the socket weld type. Joints in the inner pipe 2-1/2 inches and larger shall be of the butt weld type with internal welding rings. Inner pipe shall be tested hydrostatically at a pressure of 225 psig for a period of at least 3 hours. All tests of both the inner pipe and outer casing shall be witnessed by a representative of The University Capital Programs before the pipe trench is backfilled.
- Ample provision for expansion and contraction of both mains in the tunnel and the branch connections shall be made by means of loops or offsets. Expansion bellows or slip joints are to be utilized only where necessity dictates and if approved by the University.
- All valves in the underground steam and condensate service shall be as follows: Low pressure steam 2-1/2 inches and larger for pressures up to 100 psig. shall be cast steel, weld end, wedge gate valve for 150# steam service. All valves 2-1/2 inches and larger for pressures 150 to 300 psi. service shall be cast steel, weld end, wedge gate valve for 300# steam service. Valves 2 inches and smaller shall be forged steel, bolted bonnet, socket weld, globe valve for 600# steam service.
- Drip traps on underground steam and condensate service shall be forged steel, inverted bucket trap.
- Insulation: Insulation of steam and return inner pipe shall be calcium silicate.

Thickness of insulation shall be 1 inch for condensate return pipe, and 2 inches for high pressure steam up to 300 psig.

- Bedding for pipe shall be compacted coarse sand placed on virgin soil.

337000 ELECTRICAL UTILITIES

- Primary Service Connections to Building:

  Facilities Management should be consulted for the primary electrical distribution voltage available on the Chicago Campus. In general, the primary electrical feeder cable for a building project shall be furnished and installed by that project. This shall include necessary switchgear, underground duct, high voltage cables, and electrical manholes. All primary electrical feeders routed inside a building shall be galvanized rigid steel conduit, properly bonded and grounded, and with high voltage warning signs.
- Source of Electrical Power:

  The campus owned distribution system on the East side of the Chicago campus is the required source of electrical power for all building projects. Special circumstances and remote locations, that incur excessive costs, may necessitate the use of service provided by the local utility.
- Service Entrance Pullbox:

  The primary service shall enter the building through a multi-cell concrete duct envelope in the basement wall and not directly into the unit sub-station. Provide a No. 12 gauge sheet steel pullbox over the ducts, see Drawings. Box size shall be determined by the number of ducts to be covered as well as the sizes of cables entering or leaving the box. The box shall have screw-on cover and shall be painted with two coats of gray enamel paint with "high voltage" stenciled on cover. The depth of box shall be a minimum of 9 times the diameter of the primary cable.
- Special Requirements:
  1. Extensions of the primary distribution system shall be part of the building design. Concept designs shall be reviewed by the University before proceeding, and special instructions will be supplied to govern this type of design.
  2. Provide a single-line drawing showing the complete final building distribution system, suitably framed in 24" x 36" size under glass to be mounted in the substation or main switchgear room.

337119 ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

- Duct banks refer to utilities and not ventilation.
- See the Telecommunication Standard for underground requirements. http://www.uic.edu/depts/accc/telecom/ted.html
- Coordinate with University utility mapping archive program.
- Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.
  1. Notify Architect and the University at least two (2) weeks in advance of proposed utility interruptions.
- Coordinate elevations of ducts and duct-bank entrances into manholes and handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and to ensure duct runs drain to manholes and handholes, as approved by Architect and the University.
- Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top-soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329000 (Planting).
- Building Entrances: Make a transition from underground duct to conduit at least 10 feet outside the building wall. Use fittings manufactured for this purpose. Follow the appropriate installation instructions below:
  1. Concrete-Encased Ducts: Install reinforcement in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall.
  2. Direct-Buried, Non-encased Ducts at Non-waterproofed Wall Penetrations: Install a Schedule 40, galvanized steel pipe sleeve for each duct. Caulk space between conduit and sleeve with duct-sealing compound on both sides for moisture-tight seal.
  3. Waterproofed Wall and Floor Penetrations: Install a watertight entrance-sealing device with sealing gland assembly on the inside. Anchor device into masonry construction with one or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.

337119.13 ELECTRICAL MANHOLES AND HANDHOLES

- Manhole cover and frame shall be similar to Neenah Foundry Company, Neenah, Wisconsin, Series #R-1769-A. The cover and frame shall be constructed of grey cast-iron with a machine finished seat and shall be cast with tag name "UIC ELECTRIC" in the top surface as indicated on the drawings.