

SECTION 12.0

CONSTRUCTION SYSTEMS AND ASSEMBLIES STANDARDS AND GUIDELINES

INTRODUCTION

The University of Houston ("University" or "UH") expects and desires state of the art, "leading edge" design from the design consultants for its facilities. However, the design of the University's facilities must occur within certain desirable guidelines and meet certain standards. This section provides the guidelines and standards for the physical construction and systems of a project. The information is presented in the UniFormat style in order to facilitate initial estimates of construction cost.

The Office of Facilities Planning & Construction (FP&C) introduced master construction specifications in June 2011. FP&C intends that the standards and guidelines in this Section and the Master Construction Specifications be used in a complementary manner. Apparent conflicts between the standards and guidelines and the specifications shall be brought to the attention of the FP&C Project Manager, or submitted by email at <http://www.uh.edu/plantops/resources/owners-design-criteria/comment/>

All variations from these guidelines and standards must be requested in writing and approved in writing by the University Project Manager.

Please note that in several places there are references to other sections in the *University of Houston Campus Guidelines and Standards* document (such as SECTION 7.0 SUSTAINABLE DESIGN GUIDELINES, SECTION 8.0 SPACE STANDARDS AND GUIDELINES, SECTION 10.0 WAYFINDING STANDARDS AND GUIDELINES and SECTION 11.0 CAMPUS LIGHTING GUIDELINES).

FACILITY PERFORMANCE

The following is a fundamental description of the facility expected and desired by the University.

- A. Basic Function:
 - 1. Provide built elements and site modifications as required to fulfill needs described in the project program.
 - 2. The complete project comprises the following elements:
 - a. Substructure: Elements below grade and in contact with the ground.
 - b. Shell: The superstructure, exterior enclosure, and the roofing.
 - c. Interiors: Interior construction, stairs, finishes, and fixtures, except fixtures associated with services and specialized equipment.
 - d. Services: Mechanized, artificial, automatic, and unattended means of supply,

- distribution, transport, removal, disposal, protection, control, and communication.
- e. Equipment and Furnishings: Fixed and movable elements operated or used by occupants in the functioning of the project.
 - f. Site work: Modifications to the site, site improvements, and utilities.
3. Code: Make all portions of the project comply with "the code". The code referred to herein consists of all applicable local, state, and federal regulations.
- a. City of Houston review and permit is not required for projects on University-owned property. The University of Houston (State of Texas) is a sovereign authority. However, the design consultants will perform their work and design the project so that it would pass a City of Houston code review for permitting if submitted for such a review.
 - b. Criteria Documents: In addition to specific regulatory requirements, the following documents are also incorporated into the definition of "the code" for the purposes of this project. Except for administrative provisions contained therein, where referenced, the role of the code official described in the document will be performed by the University through the University of Houston System's ("System" or "UHS") Facilities Planning and Construction office ("FP&C").
 - c. Regulatory Documents:
 - i. City of Houston building, plumbing, mechanical and electrical codes with local amendments. Current versions are: 2012 IBC, 2012 Uniform Mechanical and Plumbing Codes, and 2014 National Electrical Code. The University uses NFPA Uniform Fire Code (**MAPP 07.02.01**).
 - ii. City of Houston construction standards for streets, storm and sanitary sewers
 - iii. National Fire Protection Association Life Safety Code 101, **2012**, with NFPA-72-2010. *Note: this edition is mandated by the State of Texas and has numerous referenced publications.*
The UH Fire Marshal's office is the officially designated Authority Having Jurisdiction (AHJ) over all Fire and Life safety-related issues. These are typically covered by NFPA or OSHA standards, as well as some municipal standards related to Houston Fire Department requirements.
 - iv. Texas Accessibility Standards and the Americans with Disabilities Act (ADA) Standards for Accessible Design; where standards disagree, the most stringent criteria shall be met.
 - v. Recognized design and construction standards such as National Electrical Code (NEC), American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), American Remodelers Institute (ART), Sheet Metal and Air Conditioning National Association (SMACNA), American Concrete Institute (ACI), Portland Cement Association (PCA), etc.
 - vi. Campus Design Guidelines and Standards. *Note: the technical standards included in this document may exceed those established in the codes referenced above.*
 - vii. State Energy Conservation Office Standards; ASHRAE/IESNA Standard 90.1-

2010

- d. Where more than one code addresses the same subject, the more stringent code shall apply.

B. Amenity and Comfort

- 1. Thermal Performance: Design and construct to provide comfortable interior environment in accordance with the code and the following:
 - a. Summer Interior Design Conditions:
 - 1) Daytime Set point: 72° F.
 - 2) Interior Relative Humidity: 50%, maximum.
 - b. Winter Interior Design Conditions:
 - 1) Daytime Set point: 72° F.
 - c. Outside Air Design Conditions:
 - 1) Summer Outside Air Design Temperature: 95° F dry-bulb; 78° F wet-bulb.
 - 2) Winter Outside Air Design Temperature: 20° F dry-bulb. (target)
 - d. Energy Design Wind Speed: 25 mph (40 km/h).

C. Health and Safety:

- 1. Prevention of Accidental Injury: Design as required by code.
 - a. Safety Glazing: Provide in locations required by code, glazed areas subject to human impact, glazed areas at grade, and doors.
- 2. Flooding Hazard: Design to prevent harm to occupants or damage to structure, service, and contents due to flooding by rising water from Brays Bayou and to overland flow from the watershed above the campus.
 - a. Establish a "Project First Floor Elevation" on upstream side of site, which must be approved by FP&C. Refer to Section A1000.
 - b. Do not provide enclosed interior spaces below Project First Floor Elevation except where existing conditions require such space to connect to existing tunnels, as determined by FP&C.
 - c. Do not provide new tunnels except where existing conditions require such construction, as determined by FP&C.
 - d. Where a tunnel has been determined to be necessary, provide watertight structural separation of utility tunnel from connection to building below first floor level. Where personnel door is required through the separation, provide a watertight structural steel ship's hatch with linked battens at each side so the door may be opened or secured from either side.
 - e. Provide flood protection levees or walls at Project First Floor Elevation around all openings into building at grade that are below the Project First Floor Elevation, and outside of the building line, should such openings be determined to be necessary by FP&C.
 - f. Provide back flow preventing valves in all storm and sanitary sewer lines (both force and gravity) at building line. Provide access for easy maintenance of the valves.
- 3. Lightning Hazard: Design to prevent damage to occupants, structure, services, and

contents due to lightning strikes.

- a. Provide protection equivalent to that specified in NFPA 780 (current edition) Supplementary strike termination devices, ground conductors, and grounding electrodes are required only where the integral portions of the structure cannot perform those functions.
- b. Ground Resistance Measurement Methods: As described in NFPA 780 (current edition), Appendix I, or IEEE 81-1983.
- c. Commissioning: Perform continuity tests for grounding conductors, equipotential bonding of other systems, and ground terminals; ground resistance test for each ground terminal, or equivalent taking into account related grounding systems.

4. Health Hazards:

- a. Design to prevent growth of fungus, mold, and bacteria on surfaces and in concealed spaces.
- b. Hazardous Construction Materials: Design and construct to comply with the requirements of the code.
- c. Indoor Air Quality: Design and construct to comply with the code and the following: Acceptable air quality as defined by ANSI/ASHRAE 62 (current edition).
- d. Commissioning: Field measure outside and supply air quantities for each space and its associated air handler.
- e. Licensed architect shall provide written and sealed/stamped verification that all included specified materials are asbestos free.

Refer to SECTION 7.0 SUSTAINABLE DESIGN GUIDELINES

5. Physical Security: In addition to any provisions that may be required by law or code, design and construct both exterior and interior spaces to incorporate accepted principles of crime prevention through environmental design (CPTED), using natural (as opposed to technological) methods of providing surveillance, access control, and territorial reinforcement wherever possible.

- a. Definition of Elements at Ground Level: For purposes of physical security, any element within 20 feet (6 m) of the ground, grade, or adjacent paving.
- b. Security Zones:
 - i. Public Access Zone: That area to which the public has free access, including public corridors, grounds, and parking lots.
 - ii. Reception Zone: The area to which the general public has access but beyond which access is restricted at all times.
 - iii. Operations Zone: The area to which only employees and visitors with a legitimate reason to be there have access.
 - iv. Secure Zone: The area to which access is always controlled and which is monitored continuously.
- c. See other Guidelines Sections for additional requirements.

Refer to SECTION 11.0 CAMPUS LIGHTING DESIGN GUIDELINES

6. Electrically-Operated Equipment and Appliances: UL listed for application or

purpose to which they are put; suitable for wet locations listing for exterior use.

D. Durability

1. Expected Service Life Span: Expected functional service life of the built portions of this project is 50 years, unless otherwise indicated in the project program.
 - a. Service life spans of individual elements that differ from the overall project life span are defined in other Sections.
2. Flood Resistance: The project is expected to stand fully operational in 3 feet of flood water as measured above the lowest first floor level allowed by code on the upstream side of the site. Refer to Section A1000.
 - a. At interiors below the Project First Floor Elevation, where determined to be necessary, provide interior construction and fixtures that are inherently water resistant.

E. Operation and Maintenance:

1. Space Efficiency: Minimize floor area required while providing specified spaces and space relationships, plus circulation and services areas required for functions.
2. Energy Efficiency: Minimize energy consumption while providing function, amenity, and comfort specified. Refer to SECTION 7.0 SUSTAINABLE DESIGN GUIDELINES.
 - a. All new construction or major renovation projects undertaken by state agencies and state supported institutions of higher education must comply with the State Energy Conservation Design Standards (Texas Administrative Code Title 34, Part I, Chapter 19, Subchapter C. Rule §§ 19.31-19.34), (Statutory Reference: Texas Government Code, § 447.004), (effective June 20, 2003) and applicable provisions of ASHRAE 90.1-2010.
 - b. A major renovation project is defined as a renovation or improvement that affects the energy or water use of the facility. For instance, a lighting project that requires engineering drawings would require certification, replacing lamps would not.
 - c. Standard for public low rise residential buildings: the energy conservation design standard of the International Energy Code Council as published in the International Energy Conservation Code (current adopted version).
 - d. Certification: State agencies and state-supported Institutions of Higher Education must require that the design architect or engineer certify that the project complies with the Energy Conservation Design Standard and submit a copy of that certification to SECO prior to construction. The certification form can be found on the State Energy Conservation Office website, <http://www.seco.cpa.state.tx.us/>.
3. Water Consumption: Minimize water consumption. Refer to SECTION 7.0 SUSTAINABLE DESIGN GUIDELINES.
4. Waste (Trash/Rubbish) Removal: Refer to Master Specification 017300 and 017700.
5. Ease of Operation: Provide facility, equipment, and systems that are easily operated by personnel with little prior training for the specific activities.
 - a. Minimize the need for specialized training in operation of specific equipment or

- systems; identify all equipment and systems for which the manufacturer recommends or provides training programs.
- b. Train University personnel in operation of equipment and systems.
6. Ease of Maintenance: Minimize the amount of maintenance required.
 7. Ease of Repair: Elements that do not meet the specified requirements for ease of repair may be used, provided they meet the specified requirements for ease of replacement of elements not required to have service life span equal to that specified for the project as a whole; the service life expectancy analysis and life cycle cost substantiation specified for service life are provided; and University acceptance is granted.
 8. Allowance for Changes in Occupancy and Arrangement:
 - a. Office Spaces: Design for churn of less than 15 percent, requiring only occasional minor changes to individual workplaces or relocation of staff.
 9. Maintenance Materials: Attic stock requirements for finish and material items (such as paint, flooring, wall covering, rest room and door hardware, or other items that require specific color, pattern, or stylistic match) shall be as defined in individual Section 12 subcategories and Master Specifications documents. If not defined, attic stock quantity shall generally be 5% and in no case more than 5%. Replacement stock, that is, only non-standard items that are location specific, may be included in major construction projects in quantities of 1-2 %.
 - a. A Maintenance/Replacement Materials (Attic stock) submittal shall be included with other required project submittals. See Master Construction Specifications Form 00 60 00 ASF.
 - b. No paint, adhesive or chemical attic stock will be permitted. Contractor shall provide the final paint schedule in PDF format and in paper format with paint chips attached. Contractor shall also provide a list of sealers and stains used on floors, tiles, and wood surfaces in PDF format and in paper format.
 - c. No light bulb attic stock will be accepted unless specialty light bulb have been installed.
 - d. No left over parts like j-boxes, conduits, ceiling grids, etc. will be accepted.
 - e. Acceptable attic stock items are listed in Master Construction Specifications Form 00 60 00 ASF. The January posting will also include new items such as wallcovering and automatic light motion sensors.
 - f. The percentage of attic stock to be supplied should be discussed with the FM supervisor of the zone in which the project is located as soon as the attic stock room size is known.

ELEMENT A

SUBSTRUCTURE

A10 FOUNDATIONS

A1000 GENERAL

1. To ensure the proper "Project First Floor Elevation", the design consultant is requested to set the floor elevation from interpretations of the existing and proposed finish grades and contours, after confirming proper drainage around the building, and referring to the applicable code. The design consultant is then directed to increase that floor elevation one foot to establish the "Project First Floor Elevation." In no instance shall the finished floor be less than one foot above the 100-year flood plain as established by TSARP. FP&C shall approve the Project First Floor Elevation.

A1010 STANDARD FOUNDATIONS

1. For occupied space at grade level, provide a structural slab over a void of sufficient depth to prevent expansion of earth resulting in pressure on the bottom of the slab. Provide precast soil retainer at perimeter grade beams to prevent soil intrusion. Apply concrete damp proofing to mitigate water vapor penetration. Exterior stairs and ramps for building occupants (not for maintenance purposes) shall also be structural slabs.
2. FP&C has traditionally required an accessible crawl space under portions of buildings where ongoing access to plumbing or other below grade systems may be required, such as at kitchens. The crawl space characteristics are a two (2)-inches thick, 2500 psi un-reinforced mud slab, properly sloped and drained; with lighting and ventilation; and three (3)-feet minimum clear dimension to facilitate form removal. Crawl spaces shall have damp proofing at bottom of slab to mitigate water vapor penetration. The geotechnical engineer on the Project shall advise whether a crawl space may be included on a project.

A1020 SPECIAL FOUNDATIONS [NOT USED]

A1030 STANDARD SLAB ON GRADE

1. Non-structural slabs on grade may be utilized with FP&C approval in basements, maintenance/storage buildings, parking garages and other outdoor structures. All other non-structural slabs may only be used upon advisement of a licensed geotechnical engineer and with the approval of FP&C. Only FP&C will make these determinations on a project-by-project basis. For non-structural slabs on grades at

conditioned spaces, a minimum 15mil ASTM E 1745, Class A vapor barrier shall be utilized.

A20 BASEMENT CONSTRUCTION: NOT ALLOWED

A2000 GENERAL

1. Basement construction, tunnels, and related slabs on grade are generally not allowed for new construction. There are existing basements and utility tunnels on the campus, and new projects may of necessity have to connect to these existing facilities. Only FP&C will determine these exceptions on a project-by-project basis. When such an exception is allowed, the new construction must safely stand alone in a flooding condition.

A2010 BASEMENT EXCAVATION

1. **Basements for habitation, storage, mechanical or electrical equipment are not allowed.** Utility tunnels and utility access basements will be approved by FP&C only as determined to be necessary by existing conditions.

A2020 BASEMENT WALLS

1. **Where basements are allowed,** provide all basement walls with waterproofing, protection board, drainage materials, French drains and geo-tech fabric.
2. **Where tunnels are allowed,** provide all tunnels with basement wall construction and floor slabs sloped for positive drainage to sump pits with pumps.

ELEMENT B

SHELL

B10 SUPERSTRUCTURE

B1000 GENERAL

- 1 Due to the characteristics of the energy source of powder-actuated fasteners, these tools pose potential health and safety hazards to the worker and the work area. The University of Houston prohibits the use of powder-actuated fasteners on new construction or renovation projects.

B1010 FLOOR CONSTRUCTION

1. Design floor structures on all major buildings to carry a minimum live load of 100lbs./s.f., unless greater is required by Code for a particular space function such as

library shelving. This allows flexibility of future design when it may be renovated. Design floors to be sufficiently rigid to prevent objectionable vibration.

B1020 ROOF CONSTRUCTION

1. Traditional pitched roofs may be considered where appropriate to the building type, aesthetic design, and roof enclosure design. Refer to SECTION 5.0 ARCHITECTURAL DESIGN GUIDELINES.
2. Refer to section B3010 for low slope roof covering options.
3. Metal deck and concrete roof slabs for new buildings will be sloped by designing the pitch into the structural frame and not by using variable thickness insulation or other non structural assemblies. Design roof to slope from the center toward the exterior walls.
4. New construction minimum 1/4" per foot as per IBC requirements in any direction; this includes cross-slopes and crickets. Re-roof minimum IBC 1/4" slope not required; zero slope variance.

B20 EXTERIOR ENCLOSURE. Refer to SECTION 5.0 ARCHITECTURAL GUIDELINES.

B2000 GENERAL [NOT USED]

B2010 EXTERIOR WALLS

1. When selecting exterior building materials, obtain approval from FP&C prior to proceeding with development of details. Final approval of desired exterior materials and color must be approved by FP&C.
2. Building design must comply with the latest ASHRAE 90.1 energy code. The design consultants are required to prepare and submit forms for compliance verification to Texas State Energy Conservation Office (SECO).
3. Choose low maintenance building materials; design for durability and to optimize material use.
4. Choose building materials with low embodied energy.
5. Exterior materials such as stucco, painted concrete, or colored porcelain are not allowed.
6. Per the Architectural Precast Concrete Sealant and Joint Guide, precast concrete panel joints shall have two sealant beads: a weather seal near the exterior face and an air/vapor barrier seal close to the interior face of the panel. The exterior weather

barrier is designed to shed most of the water from the joint, and the interior air vapor seal is the demarcation line between outside and inside air pressure. Between the two joint sealants is an air cavity which must be vented and drained to the outside.

Air tightness of the air vapor barrier seal is critical, as is the sizing of the weather seal openings which govern the speed at which pressure equalization occurs. Pressure equalization must take place almost instantaneously for a joint to be effective.

Water in precast panel joints, either from penetration or condensation, should be drained from the joint by proper flashing or transverse sealant bead installations. The Guide advises using these flashing details as dampers to avoid vertical movement of the air in the joint chamber caused by wind, outside air turbulence and stack effect. Flashings using the sealant should be installed at regularly spaced intervals along the height of vertical joints, usually near the junction of the horizontal and vertical joints at each floor level. Therefore, if any moisture does come out of the system, it will run down the face of the joint sealant and not over the face of the panels.

Panel configurations and joint sizes should permit a careful applicator to successfully install both the air/vapor seal and the weather barrier from the exterior. The normal positions of the backing and sealant are reversed for the interior air seal. (*Architectural Precast Concrete Sealant and Joint Guide, www.cpci.ca*)

B2011 BRICK

1. Brick will be selected during project design and shall be specified in the bid documents.
2. The predominant brick color for use on the campus of University shall be buff (Acme PEP 30 dove gray w.k/s velour) as used at Calhoun Lofts, among other buildings.
3. The dark accent brick used at Calhoun Lofts, Acme DTP 153 Ebony with k/s velour may also be used as an accent on new buildings.
4. Other compatible brick choices with approval of FP&C/FM Core Team.

B2012 STONE AND CAST STONE

1. Cut stone shall be Cordova Cream Texas Limestone.
2. Cast Stone shall be mixed thoroughly dry as follows: One (1) sack Atlas White Portland Cement with one (1) oz. of Lambert Bright Yellow Color. After blending the above, use the following mixture: Four (4) parts "Big Sandy" sand to one (1) part of blended cement color mixture.
3. Stone should match stone on Ezekiel W. Cullen Building (west façade).

4. Use stainless steel accessories for attachment.
5. Use the Indiana Limestone Handbook as a detailing guide.

B2013 CONCRETE MASONRY UNITS

1. Use bull nose type concrete masonry units at all edges and exterior corners.
2. Provide damp-proofing behind all masonry.
3. Use of CMU for elevator shafts, mechanical, pump rooms and service docks is encouraged.
4. Provide vertical reinforcing rod in solid grout at all corners, end conditions and jambs.
5. Provide joints at each side of pilasters; use flexible ties to connect one joint to the continuous wall.

B2015 METAL PANELS [In Development]

B2017 EXTERIOR GRAPHICS

1. Building name signage shall be inscribed or surface-mounted in accordance with SECTION 10.0 WAYFINDING.
1. Building name shall be illuminated in accordance with SECTION 11.0 LIGHTING DESIGN GUIDELINES. Exterior and internal illumination of signs shall be reviewed by the Campus Facilities Planning Committee.
2. Each building shall have its street number posted on the building where it is visible to emergency vehicles. The street number shall contrast with its background and shall be visible at nights and during all seasons.
3. Dedication plaques shall be of incised stone or cast metal in accordance with SECTION 10.1.4.

B2020 EXTERIOR WINDOWS

Refer to SECTION 5.0 ARCHITECTURAL DESIGN GUIDELINES and SECTION 7.0 SUSTAINABLE DESIGN GUIDELINES.

1. Heads, jambs and sills of windows in walls shall be flashed and caulked or sealed during the window installation, prior to the placement of snap-on moldings or covers, to insure that concealed surfaces are properly sealed against the penetration of wind and water. All windows (including those with integral sill

flashing) shall, subject to manufacturer's agreement, be installed above a sill pan with end dams. All windows should have drips at heads and sills.

2. If double-glazed windows are used, use thermal break aluminum window sections.
3. Projected, movable sash windows, casement type windows, and flush mounted windows are difficult to maintain watertight and their use is discouraged.
4. Design windows with maintenance in mind and include provisions for cleaning windows above third floor. Window washing and window replacement requirements need to be considered during design.
5. Skylights are discouraged. When they are approved, specify double-glazing, thermal breaks, interior gutters and insulated curbs.
6. Windows shall have transparent low-e energy efficient double-glazing. Other energy efficient glass such as frit screened or lightly tinted may be used when necessary to meet energy codes and when approved by FP&C. Highly reflective glass shall not be used. Since the adoption of ASHRAE 90.1-2010, the most commonly specified window glass on campus has been Solarban 70XL.

B2021 SUN AND GLARE CONTROL

1. Exterior: protect all glazed areas on the southeast, south, southwest, and west facades from direct exposure to the sun during all seasons.
2. Interior: Vertical window blinds are not acceptable. Provide Meco-Shade or Draper mechanically-operated shades at all windows in building envelope. Larger or inaccessible openings may require motorized operation. Contact FPC Project Manager regarding shade. Vertical window blinds are not acceptable color/texture/pattern. As shade width increases (typically over 9 ft./108 in.) reduce overall shade width by splitting one wide shade into two or more shades; or increase the tube diameter and add a horizontal batten for every roll width (6 ft./72 in.-8.5 ft./98 in.).

As the shade height increases (no range provided by manufacturer), combat the tendency for the shade edge to curl and wave by splitting the shade vertically into two or more shades; or increase the tube diameter and add a horizontal batten for every roll width (6 ft./72 in.-8.5 ft./98 in.). Note also effect of direct downlighting and adjacent ventilating air on shade aesthetics.

3. Provide mini-blinds or appropriate visual privacy treatment for offices, conference rooms and private spaces.

B2030 EXTERIOR DOORS

- a. Thresholds shall be no greater than 1/2" height and beveled. Use heavy-duty thresholds with maximum anchorage.
- b. Use thresholds and weather stripping at exterior doors to prevent air and water infiltration. Rain Guards shall be used on any exterior application with less than a two-foot overhang above the door.

1. Doors and Frames

- a. Exterior hollow metal doors are to be heavy duty galvanized, 18-gauge minimum with a 16 gauge minimum frame.
- b. Snap-in frames are not permitted on exterior doors.
- c. Exterior personnel doors shall not be larger than 7 feet high. Avoid use of single doors over 8 feet high and 3 feet wide.
- d. All general use entrances require a vestibule. Protect exterior doors with overhangs.
- e. All door glass and side-lights are to be laminated safety glass, except when wire glasses required in fire-rated doors and windows.
- f. Coordinate finish of metal frames with hardware or adjacent metal (i.e. specify bronze thresholds and bronze finish closers, if metal frames have bronze finish).
- g. Warning bars or cross mullions shall extend across all full height glazed areas. Meet requirement of "Model Safety Glazing Code" and "Consumer Product Safety Commission" and "Way Faring Guidelines".
- h. Provide 1/8" clearance around all sides of doors.
- i. All hardware shall conform and meet all ADA code requirements including installation.
- j. Aluminum framed glazed entrance assemblies shall not be less than heavy-duty wide style to receive locksets or panic hardware. Custom styled doors with vision panels may be used. Locksets and/or panic devices shall be at conventional height and are not permitted in bottom rails. Frameless glass doors are not allowed.
- k. Custom finishes on doorframes are not allowed.
- l. Single Point Latching is highly preferred.

2. Testing

- a. Ensure that windows, doors and louvers are designed for adequate wind loading and velocity pressures per code.
- b. All doors shall be tested for ADA Compliance.
- c. All doors shall be tested and adjusted following any air balancing.

3. Mullions

- a. Removable center mullions most commonly used on campus need to be approved by FP&C. Where approved, use key cylinder "Best 7-pin" lockable mullion.
- b. Key to Mullion will be issued to select persons who oversee the building and insure that the mullion is replaced once removal is needed.

B2031 EXTERIOR DOOR HARDWARE

1. Thresholds
 - a. Use thresholds and weather stripping at exterior doors to prevent air and water infiltration. Rain Guards shall be used on any exterior application with less than a two-foot overhang above the door.

2. Approval Procedures
 - a. All deviations from these guidelines must be requested in writing and approved by the Assistant VC/VP, Public Safety and Security including the UH Access Control Shop.
 - b. Final keying will be coordinated and approved by the UH Access Control Shop. UH DPS must approve card access system.

3. Cores Existing Renovations
 - a. Lock cylinders to accept Best Access Systems 7-pin IC cores—American type only. Contractor must provide construction cores. Door and mortise locks shall be Sargent 8200 Series.

4. Core New Build-Out
 - a. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
 - b. Provide Cylinders with removable and interchangeable core system: BEST CORMAX Patented 7-pin system.
Provide endurance, attack resistance, and harsh environment key system protected by US utility patent 7,681,425 (expiration May 2027), which has controlled distribution through Stanley and/or its Authorized Distributors and requires authorization through Stanley Patented Masterkey System Security Authorization Form for sales and shipment of Stanley patented cores to individuals noted on the form. Patent is inclusive of cores certified to meet the security, safety, and reliability requirements of BHMA A156.5 Grade 1, and are compatible with all existing SFIC interchangeable core housings, eliminating the need for new or modified locksets.
 - c. Provide individually capped core pin chambers to minimize re-pinning labor.
 - d. Provide Permanent keys and cores stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate".
 - e. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested. No other means of transmission will be permitted.

- f. Furnish Nickel silver keys and steel clips to ensure long and reliable operation.
 - g. Furnish keys in the following quantities:
 - i. 1 each Grand Masterkeys
 - ii. 1 each Masterkeys
 - iii. 1 each Change keys each keyed core
 - iv. 15 each Construction masterkeys
 - v. 1 each Control keys
 - h. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
 - i. Keying Schedule: a keying meeting, with the Owner and the Best Keying Specialist shall take place after the hardware supplier has ordered the keyed cylinders and locks. The Owner will verify the lock and exit devices are functionally correct and the keying complies with project requirements. The Mfg. will furnish three typed copies of keying schedule to the Owner.
 - j. On renovation projects, the University of Houston Access Control Shop will determine keyway requirements for lock cylinders. Removal of existing cores shall be requested by a recoverable cost work request (<https://accessuh.uh.edu/index.php>). Existing University cores will be removed and set aside, and vendor supplied construction cores maybe installed by vendor, unless work in being completed by in-house workers which the UH Access Control shop will provide and install construction cores during the renovation process. Vendor supplied construction core, Vendor will provide the UH Access Control Shop copies of all keys or complete code list. UH Access Control Shop will replace the construction cores with the University cores after construction is completed unless UH Access Control shop direct vendor otherwise.
5. Hinges and butts
- a. Three hinges per leaf to 7 feet, 6 inch in height, add one hinge for each additional 30 inches in height, or fraction thereof.
 - b. All doors over three feet in width will have heavy-duty ball bearing hinges also doors with panic or fire hardware devices.
 - c. Out swing, exterior doors will be non-ferrous with non-removable pins (NRP).
 - d. Non-ferrous material on exterior doors and at doors subject to corrosive atmospheric conditions.
 - e. Provide shims and shimming instruction for proper door adjustment.
 - f. All glass storefront type doors equipped with pivots shall have an intermediate jacking pivot set to correct the height of the doors.
 - g. All high traffic doors should be so equipped with a full continuous gear hinges.
 - h. Exterior doors shall have Grade 1 commercial heavy-duty pivots, commercial heavy-duty ball bearing butt hinges, or continues gear hinges.
6. Door Closers

- a. Use Sargent Model 351 door closers on exterior and interior doors with four (4) adjustments. Door closer must be securely mounted to the surface utilizing through-bolt.
7. Card Readers
- a. All new buildings shall provide electrified hardware on all exterior doors, and a minimum of two doors having card access with an approved automatic operator, both with key override and both integrated into the campus wide access control system (refer to D5040). Doors with Automatic operators (ADO) shall have both a proximity and magnetic strip format reader. All exterior doors shall be able to be secured & unsecured electronically from the DPS Communications Center. Specifications for special security locks must be reviewed and approved by UH Access Control Shop.
 - b. Hard-wired on-line locks are to use on all perimeter doors allowing access to interior of the building, and on occupancies space with 50 or more. Hard-wired locks have the fastest propagation delay to a lock-down order and therefore optimize security in areas exposed to greater risk. Exterior doors not providing access and only utilized for egress may have all exterior trim removed but shall have door contacts for position monitoring and REX on the egress side. Dummy cores may be installed to disable exterior hardware as an option to full removal and patching of the hardware set.
 - c. Hard-wired electrified hardware installations must have Von Duprin or series 80 Sargent exit devices (the campus standards). Wireless installations shall have Precision panic hardware for consistency throughout campus.
 - d. All perimeter doors must have request to exit function.
 - e. All perimeter doors shall have door position monitoring capabilities in a supervised mode.
 - f. Off-line Readers can only to utilize in spaces that are not normally occupied and that will always be operated without a time zone and in secured mode, such as storage, equipment rooms, etc. A maximum of twenty client-defined users are allowed. PIN codes shall only be allowed if the hardware is operated in dual validation mode. Restrictions on offline locks have been imposed because they cannot be controlled in a lock down situation. Furthermore, deactivation or addition of a user requires someone to visit the lock and download a new user list.
 - g. Mechanical or electronic PIN Code Locks should no longer be utilized. PINs are easily shared and there is no accountability of who may have received the PIN. All PIN Code locks will have to be replaced with card reader type electronic locks as funding is available.
 - h. Wireless on-line locks can be used in occupancies of 49 or less. Space must normally be operated without a time zone and secured in card mode. Because of the propagation delay associated with a lock down order, wireless on-line locks should not be used on perimeter doors allowing access to interior corridors or tunnel system, or classroom doors to include laboratories.
 - i. Existing exterior doors will be retrofitted with electrified hardware as outlined above when buildings are remodeled, or as funding becomes available.

- j. Demolition of all electric mechanical hardware on all doors shall be coordinated with FM Building Maintenance and FP&C before being discarded. All small parts shall be bagged and attached to the correct door/part.
 - k. Student Housing options all common doors and community used space such as laundry, exercise, kitchens, and/or game rooms) shall have on-line hard-wired card reader systems. Private space may be design to utilize Off-line hotel style function access control locks. Although wireless on-line locks maybe a more accommodating design. All other doors shall meet with all other design guild lines.
8. Automatic Doors (ADO)
- a. Automatic operating doors may be sliding or swinging, as appropriate to the building use and design, with safeguards and handicapped accessibility as necessary. Door types, materials, hardware, and sensors shall be established designs with proven field experience under similar usage. Preferred manufacturers are Horton for swinging doors, and Stanley or Record USA for sliding doors. Consideration shall be given to availability of trained serve technicians and spare parts.
 - b. Automatic doors are preferred in high traffic areas.
 - c. One automatic door opener (ADO) shall be located in a major entrance at the most used location along the accessible pathway or route. The second shall be located either by the loading dock or at the door closest to the parking lot used by building occupants after hours or weekends. See also card access requirements for automatic operating exterior doors below.
 - d. Automatic doors should be wired so that the unlocking and locking of the door is day mode function.
9. Finishes
- a. Door trim and hardware finish color shall match existing hardware (levers lock, etc.) in building.
 - b. All door handles shall be "P" handle type or return type.
 - c. All new finish hardware to be Satin Finish. Do not use polished finishes.
10. Approved Hardware
- a. Mortise deadbolts must be Sargent and must conform to fire/life safety code. Interior handle must retract deadbolt in one action. All machine rooms, custodial closets, telephone rooms, elevator machine rooms, mechanical rooms, and electrical rooms must have door closers and self-relocking. (Storeroom Function).
 - b. Use Sargent 80 Series or comparable Von Duprin exit devices (panic hardware). Custom panic devices are not allowed. Do not use concealed vertical rods for panic hardware. Surface mounted vertical rods are recommended.
 - c. Surface vertical rods are permitted and encouraged at loading dock doors only as long as rod and latch guards are installed. Single Point latching panic bars should be first choice of design and where applicable. Allow space between the door head and the ceiling for maintenance and repair.

- d. Avoid use of active/inactive leaf doors with coordinators when other hardware can be used to meet fire codes. Key removable mullions acceptable.
 - e. Kick plates shall be specified for inside of exterior doors.
 - f. Use floor mounted doorstops to prevent wall damage.
 - g. All Panic Device should be mounted to each door utilizing the through-bolting method wherever applicable. End Caps and covers must be secured to the brace with security screws.
 - h. Classroom door maybe equipped with a manual lock down deadbolt that can be utilized in the event of emergence from inside the room by the turn a thumb turn on the lock. Egressing the space can always be done so by pressing or turning the door knob/lever. Single action only. Access to this space will be accomplished by key when deadbolt is activated. Deadbolt can also be unlock with the inside thumb turn. Due to design card access system will be de-activated if deadbolt is activated.
11. Rollup doors.
- a. Operation - Operation Type: Motor type
 - b. Curtains - Material: The curtain shall consist of 18 gauge (.047 minimum steel thickness) steel interlocking slats. Steel slats shall be roll-formed from commercial quality hot-dipped galvanized (G-90) steel per ASTM A-653.
 - c. Finish/Color:
 - i. The curtain shall be finished in Gray: as normally-provided, one coat white epoxy primer and one top coat of gray polyester paint.
 - d. Endlocks:
 - i. Lateral movement of the slats to be contained by means of zinc-plated malleable cast-iron endlocks fastened with two zinc-plated steel rivets.
 - e. Bottom Bar and Seal:
 - i. Bottom bar shall be two roll-formed galvanized steel angles, minimum 1 ½" x 1 ½" x 1/8" (38.1 mm x 38.1 mm x 3.2 mm). Bottom astragal shall be single-contact type. Structural angle bottom bar shall receive one coat of rust-inhibitive primer
 - f. Wind load:
 - i. Doors shall be designed to withstand 20 pounds per square foot (87.64 kg/sq.m.) wind load.
 - g. Vision Panels:
 - i. Rolling service door may be furnished with 4" x 1" (101.6 mm x 25.4 mm) Plexiglas vision panels, 1/8" (3.2 mm) thick for flat and large curve slats and 5/8" (15.9 mm) for insulated flat slat with quantity and locations detailed on door elevation drawing (delete this section if not applicable).
 - h. Curtain Wear Straps.
 - i. Rolling service door may be furnished with polyester wear straps to discourage the curtain from premature wear resulting from coiling of the door (delete this section if not applicable).
 - j. Jambs Mounts
 - i. Steel Jambs: as normally-provided, and supplied with self-tapping fastener.
 - ii. Wood Jambs: as optionally-provided, and supplied with lag bolt fasteners.

- iii. Masonry Jamb: as optionally-provided, and supplied with anchor bolt fasteners.
- i. Weather Seal: Rolling service door may be provided with guide brush seal or snap-on vinyl seal.
- k. COUNTERBALANCE SYSTEM
 - i. Counterbalance: The curtain shall be counterbalanced by means of torsion Spring: as normally provided, consisting of oil-tempered, helical torsion springs, grease packed and mounted on a continuous steel torsion shaft or Weight Counterbalance: as optionally-provided, for promoting high cycle life durability.
- l. HARDWARE
 - i. Lock: Rolling service door may be provided with a lock cylinder lock that accepts a SFIC cylinder: as optionally provided and available for use with hand chain, and hand crank operated doors (motor operated doors will require an interlock switch with the SFIC cylinder lock).
 - ii. Door shall be provided with door position contact and remote down relay to be tied into the card access system (BASIS) for remote closing of door.
 - iii. All safety devices shall interrupt remote closing until safety is cleared then door should resume closing process.

B30 ROOFING

B3000 GENERAL

1. When replacing existing or adding on to existing roofs, review the original design thoroughly before making any change in type of roofing to be used. **NOTE:** For any new or renovated roof projects that involve the use of asphalt or urethane materials, the contractor must submit Material Safety Data Sheets (MSDS) to the University upon project completion.

B3010 ROOF COVERINGS

Refer to SECTION 5.0 ARCHITECTURAL DESIGN GUIDELINES

1. Traditional pitched roofs of standing seam metal or clay tile or curved roofs of standing seam metal are encouraged.
 - a. Provide double lock standing seam roof design. Snap caps are not allowed. Design to SMACNA requirements.
 - b. Standing seam roofs should be used only when there is sufficient slope and the design is simple. The design should have no penetrations. If dormers are used the design should be such that the entire dormer assembly is simple and covered by the roofing warranty.

- c. Provide clay tile design and specification to meet or exceed “Ludowici” installation requirements.
 - d. Standing seam and clay tile slopes will be sloped per manufacturer’s recommendation.
2. The University’s preferred low slope roofing systems include a hybrid single ply system and a high-tier modified bitumen system. A utilitarian grade modified bitumen system may be allowed in certain instances. Refer to the Master Specifications Division 07.
- a. Recent roofing industry reporting advised that torch and hot asphalt applied roofing have superior bonding over cold applied roofs. Once cool, torch and hot applied roofs do not emit VOC’s (Volatile Organic Compounds) into the air. Cold asphalt adhesives, however, contain solvents that are high in VOC’s. After installation approximately 50% of the pails’ content of cold asphalt adhesive evaporate into the air.
 - b. All low-slope roofs will have a minimum 1/4” per foot slope or greater if required by manufacturer’s warranty.
3. Roof Accessories
- a. Elevated roof expansion joints are required.
 - b. Scuppers: Size and locate roof scuppers to carry water off in the event of roof drain stoppage. Size scuppers large enough to float out empty soft drink cans. Scuppers are preferred in lieu of overflow drains.
 - c. Pipe Supports: Non-ferrous, non-corrosive type as recommended by roof manufacturer for proper pipe support and weight distribution on roof; supports shall provide unbinding thermal expansion/contraction movement of piping without jeopardizing warrant ability of roof system. Set supports on additional wearing surface of cap sheet layer or walk-pad material.
 - d. Equipment Supports: As recommended by both the roof system manufacturer and the equipment manufacturer. Equipment curbs and base flashing must be at least 8” high.
 - e. Walkways: To prevent damage to roof areas around equipment maintenance access areas, mop down a walkway layer of 90 lb. cap sheet over installed cap sheet. The 90 lb. cap sheet walkways to roof mounted equipment and around access hatches are to be 3 feet wide. Provide walkway pads at high and low step-offs at each roof ladder and entrance ways to roof. Other walkway systems to be acceptable must be approved by University of Houston.
4. Slope
- The roof must slope to the drains. Refer to Section B1020.4.

- a. Secondary slopes and crickets to roof drains may be sloped with tapered insulation.
 - b. Roof structure is required to be sloped in B1020. Meet "Factory Mutual 90" design criteria unless directed otherwise.
 - c. Tops of equipment curbs shall be level in all directions.
 - d. Roof hatch tops shall slope to drain.
 - e. Copings shall slope towards roof minimum 1" across width for drainage.
5. Roof designs and detailing will be reviewed and accepted for warranty purposes by manufacturer's engineers prior to issue for bidding.
 6. Galvanized metal flashing is not allowed. Aluminum or stainless steel is recommended.
 7. Pitch pans are not allowed. Flash or boot all roof penetrations.
 8. Aluminum cap flashing, or standing seam profile coping (or stone coping assembly design to be approved by FP&C) is required on top of parapets.
 9. Breather vents in roofing systems are not allowed.
 10. Pitch and spray-on foam type roofs are not allowed.
 11. Design roof to minimize roof penetrations. Design to limit roof mounted equipment. Encourage design of vents and intakes to be in vertical walls, not as roof penetrations.
 12. Lightweight concrete insulating fill roof decks will not be allowed. Lightweight structural concrete is allowed.

B3020 ROOF OPENINGS

1. All roofs over one story will have access by stair or roof-hatch. Provide lockable hatch with Best cylinder.

ELEMENT C

INTERIORS

C10 INTERIOR CONSTRUCTION

C1000 GENERAL

1. Required Spaces

- a. Donor Signage Area.
 - i. Design consultant shall propose interior wall space near the main entry to allow for donor recognition signage.

- b. Custodial Storage Room and Requirements
 - i. A storage room is to be 8'x12'. Do not locate storage room next to trash room
 - ii. Custodial requirements for offices and classrooms
 - For office trash receptacles, use SAFCO SAF-9616 BL.
 - For classroom trash receptacles, use SAFCO SAF-9618 BL.

- c. Trash Room.
 - i. Trash rooms shall not be provided in classroom and office buildings due to problems with odors and pest infestation.
 - ii. Trash room locations in other buildings shall allow for maneuvering of large refuse carts in and out of the space. If trash room door is inset, corner protection at adjoining walls shall be provided. The trash room door shall be oversized or otherwise allow for a full 36" clear opening. In addition, the trash room door shall feature a magnetic door holder which releases the door to close upon fire alarm signal.

- d. Recycling Rooms (On Each Floor)
 - i. A recycling room for storage of recyclable materials is to be a minimum of 8'x8'. Locate adjacent to or close to the Custodial Closet.
 - ii. New construction shall include on each floor recycling alcoves sized to enclose a minimum 96 gallon size wheeled recycling container. Recycling alcoves shall be coded X041 for incorporation into sustainability metrics. Recycling alcoves may not be located along egress corridors for the following reasons: Recycling bins in an alcove in an exit corridor do not meet code for the following reasons: bins are light and can be moved, when bins are full occupants will continue to pile recyclables in and around the bins obstructing egress; and were the bin to catch fire it would produce enough smoke and heat to prevent occupants access to, egress from, or visibility of the means of egress.

- e. Attic Stock Room.
 - i. Provide an attic stock room (minimum 8' x 8' in size) for storage of maintenance or replacement finish materials. Locate adjacent to or close to Custodial Storage or main mechanical room.

| 2. Floor and Room Number Assignment and Identification. |

a. Floor and Space Identification Systems.

Contact Facilities Information regarding current numbering protocols

- i. Each space shall be identified by room name and number.
- ii. Room numbers used in the Construction Documents will become the actual and permanent room numbers.
- iii. Proposed numbering system will be approved by FP&C.

b. Assignment of Floor Numbers

- i. The floor level containing the primary entrance shall be considered the First Floor and shall be numbered in the 100 series; the floor above being the Second Floor shall be numbered in the 200 series.
- ii. Third and subsequent floors shall be numbered in a similar manner.
- iii. Below grade levels, if allowed, shall be numbered in the 001 series.

c. Assignment of Room Numbers

- i. The rooms on each floor opening off a corridor shall be numbered consecutively in a clockwise direction from the primary entrance, which shall be X00.
- ii. Rooms and spaces not opening off a corridor shall carry the room number of the connecting room with an additional suffix letter (108A, B, C, etc.). Letter clockwise, if more than one room is involved.
- iii. Stairwells should be labeled and floor numbers posted on inside of doors in accordance with NFPA 101.

-Note: Room number 420 shall be avoided.

d. Assignment of Door Numbers

To allow integration of lock shop data into FAMIS, doors on floor plans shall be assigned numbers based on the room which the hardware serves. Hardware on a typical office door located, say, between corridor 100 and Office 112, should be assigned the number 112. An interior closet in Office 112 will also include the 112 in the lock number series. Exterior doors shall be numbered consecutively along the perimeter of the building.

-Format shall be

Building number - room number - number (1, 2, 3, etc., based on primary and secondary doors) - space use suffix.

Example for a door to an interior room: 585-112-01-IN
Example for a door to a smaller room within an interior room: 585-112-02-IN
Example for a door between corridors: 585-102-01-CR
Example for an exterior door opening onto Lobby 100: 585-100-01-EX
Example for a door into stairwell A: 585-A103-01-ST

3. Acoustical Quality/Vibration Control

- a. Analyze each space or room for the purpose of insuring acoustical quality and vibration control.
- b. Room acoustics and control of mechanical noise and vibration is a requirement of the design consultant’s standard professional service.
- c. The design consultant is charged with achieving a good educational environment in his design product to include educational spaces, offices, and corridors.
- d. Noise Criteria (NC) figures for different spaces should be as follows (based on ASHRAE Handbook Systems Volume, Latest Edition).

Space	Criteria
Offices	NC-35
Executive Offices	NC-30
Lecture Rooms	NC-30
Major Lecture Halls	NC-30
Auditoriums	NC-30
Corridors	NC-45
Classrooms	NC- 35
Laboratories	NC- 40
Libraries	NC-30

- e. Acoustical performance of general usage partitions should be equal to or greater than the following Sound Transmission Class (STC) ratings (based on Uniform Building Code 1997 and U.S. Dept. of HUD requirements):

Partitions dividing	Criteria
General Offices	STC-40
Executive Offices	STC-50
Classrooms	STC-50
Corridors	STC-50
Lecture Rooms	STC-55
Mechanical	STC-55
Conference Rooms	STC-55

- f. Some partitions may require greater acoustical attenuation to achieve a given NC performance rating in a space depending on specific situations; for example, a partition separating a mechanical room and lecture room.
- g. Lecture room and lecture halls should have an average reverberation time that is less than or equal to one second for frequencies between 500 and 2000Hz.

C1010 PARTITIONS

1. Partitions enclosing corridors, mechanical, electrical and restrooms are permanent and require more substantial construction than secondary partitions. Include STC and fire rating in the partition schedule.
2. Use metal studs. Sixteen inches (16") stud spacing is required. Size gauge for span and load.
3. Wet walls are required to be cement board.
4. Where abuse of wall surfaces is anticipated gypsum board walls will be composite cement board or glass fiber reinforced gypsum.
5. Gypsum board walls are required for all general purpose applications. Consider installing fire-rated gypsum board (Type X) for all installations even if not technically required.
6. Wall should extend from floor to structure.
7. Do not use masonry load-bearing walls as partitions.
8. Do not use 2 inch solid plaster partitions.

C1020 INTERIOR DOORS

1. Standards for interior doors are 3 ft. wide by 7 ft. high, solid wood core, stained (preferred) or plastic laminate finish.
2. Except for fire-rated doors, use lumber core doors only. Particle board cores are not acceptable. Door faces to be paneled wood or wood veneer.
3. Avoid use of single doors over 8 feet high and 3 feet wide.
4. Pocket doors and folding doors shall not be used without approval of FP&C/FM.
5. Small wire glass vision panels (8 inches by 33 inches) in metal frame in doors to laboratories, classrooms, conference rooms, offices or any space where flammable or combustible material is to be used are recommended.
6. Use 3-piece aluminum door jambs except as required by fire codes for labeled doors.
7. Do not use knock down hollow metal door frames in new construction.

8. All door glass and side-lights to be laminated safety glass, except when wire-glass is required in fire-rated doors.
9. Provide 1/8 inch clearance around all sides of doors.
10. Do not use removable center mullions for doorways.
11. Corridor doors to open out.
12. All doors that are specified to have electric mortised locks shall be factory prepped with an electrical raceway from the hinge to the lock and shall be so noted on the construction documents hardware schedule.
13. All electrical rooms shall have a panic bar and a panic bar through all other exiting door(s) where an injured person may receive rescue. Door(s) shall be fire rated for 1 ½ hours.
14. All high voltage vaults shall have a panic bar and a panic bar through all other exiting door(s) where an injured person may receive rescue. Door(s) shall be "labeled" fire rated for 3 hours.

C1025 INTERIOR DOOR HARDWARE

1. Thresholds
 - a. Thresholds on handicapped accessible routes shall be no greater than ½" high and beveled.
 - b. Use heavy-duty thresholds with maximum anchorage.
2. Approval Procedures
 - a. All deviations from these guidelines must be requested in writing and approved by the Assistant VC/VP, Public Safety and Security including the UH Access Control Shop.
 - b. Final keying will be coordinated and approved by the UH Access Control Shop. UH DPS must approve card access system.
3. Cores Existing Renovations
 - a. Lock cylinders to accept Best Access Systems 7-pin IC cores—American type only. Contractor must provide construction cores. Door and mortise locks shall be Sargent 8200 Series,
4. Core New Build-Out
 - a. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same

keyway (or key section) as the Owner's permanent keying system.

Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

- b. Provide Cylinders with removable and interchangeable core system: BEST CORMAX Patented 7-pin system.
- c. Provide key system protected by US utility patent 7,681,425 (expiration May 2027), which has controlled distribution through Stanley and/or its Authorized Distributors and requires authorization through Stanley Patented Masterkey System Security Authorization Form for sales and shipment of Stanley patented cores to individuals noted on the form.
- d. Provide endurance, attack resistance, and harsh environment resistance.
- e. Provide A second, independent locking mechanism that utilizes a patented set of built-in side pins to provide higher security. Cores will only operate when the proper keys are inserted to disengage the patented built-in side pins from the body and sleeve.
- f. Provide cores certified to meet the security, safety, and reliability requirements of BHMA A156.5 Grade 1.
- g. Provide cores that are compatible with all existing SFIC interchangeable core housings, eliminating the need for new or modified locksets. Provide individually capped core pin chambers to minimize re-pinning labor.
- h. Provide Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do not duplicate."
- i. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- j. Furnish Nickel silver keys and steel clips to ensure long and reliable operation.
- k. Furnish keys in the following quantities:
 - i. 1 each Grand Masterkeys
 - ii. 1 each Masterkeys
 - iii. 1 each Change keys each keyed core
 - iv. 15 each Construction masterkeys
 - v. 1 each Control keys
- l. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- m. Keying Schedule: a keying meeting, with the Owner and the Best Keying Specialist shall take place after the hardware supplier has ordered the keyed cylinders and locks. The Owner will verify the lock and exit devices are functionally correct and the keying complies with project

requirements. The Mfg. will furnish three typed copies of keying schedule to the Owner.

- n. On renovation projects, the University of Houston Access Control Shop will determine keyway requirements for lock cylinders. Removal of existing cores shall be requested by a recoverable cost work request (<https://accessuh.uh.edu/index.php>). Existing University cores will be removed and set aside, and vendor supplied construction cores maybe installed by vendor, unless work in being completed by in-house workers which the UH Access Control shop will provide and install construction cores during the renovation process. Vendor supplied construction core, Vendor will provide the UH Access Control Shop copies of all keys or complete code list. UH Access Control Shop will replace the construction cores with the University cores after construction is completed unless UH Access Control shop direct vendor otherwise.

5. Hinges and butts

- a. Three hinges per leaf to 7 feet, 6 inch in height, add one hinge for each additional 30 inches in height, or fraction thereof.
- b. All doors over three feet in width will have heavy-duty ball bearing hinges or doors with panic or fire hardware devices.
- c. Out swing, interior doors will be non-ferrous with non-removable pins (NRP).
- d. Non-ferrous material on exterior doors and at doors subject to corrosive atmospheric conditions.
- e. Provide shims and shimming instruction for proper door adjustment.
- f. All glass storefront type doors equipped with pivots shall have an intermediate jacking pivot set to correct the height of the doors.
- g. All high traffic doors should be so equipped with a full continuous gear hinges.
- h. Interior doors shall have Grade 1 commercial heavy-duty pivots, commercial heavy-duty ball bearing butt hinges, or continues gear hinges.

6. Door Closers

- a. Use Sargent Model 351 door closers on interior doors with four (4) adjustments. Door closer must be securely mounted to the surface utilizing through-bolt. Floor type and overhead-concealed door closers are not acceptable.

7. Card Readers

- a. Hard-wired on-line locks should be used on all interior spaces of the building with occupancies space with 50 or more. Hard-wired locks have the fastest propagation delay to a lock-down order and therefore optimize security in areas exposed to greater risk. Interior doors not providing access and only utilized for egress may have all exterior trim removed but shall have door contacts for position monitoring and REX on the egress side. Dummy cores may be installed to disable exterior hardware as an option to full removal and patching of the hardware set.

- b. Hardwired electrified hardware installations must have Von Duprin or series 80/82 Sargent devices (the campus standards). Wireless installations shall have Precision panic hardware for consistency throughout campus.
- c. All doors with card reader must have request to exit function.
- d. All doors with Card reader shall have door position monitoring capabilities in a supervised mode.
- e. Off-line Readers may only be utilized in spaces that are not normally occupied and that will always be operated in a secured mode. (No auto unlocking) such as storage, equipment rooms, etc. A maximum of twenty client-defined users are allowed. PIN codes shall only be allowed if the hardware is operated in dual validation mode. Restrictions on offline locks have been imposed because they cannot be controlled in a lock down situation. Furthermore, deactivation or addition of a user requires someone to visit the lock and download a new user list.
- f. Mechanical or electronic PIN Code Locks should no longer be utilized. PINs are easily shared and there is no accountability of who may have received the PIN. All PIN Code locks will have to be replaced with card reader type electronic locks as funding is available
- g. Wireless on-line locks can be used in occupancies of 49 or less. Space must normally be operated in a secured mode (no automatic unlocking). Because of the propagation delay associated with a lock down order, wireless on-line locks should not be used on perimeter doors allowing access to interior corridors or tunnel system, classroom or laboratories.
- h. Demolition of all electric mechanical hardware on all doors shall be coordinated with FM Building Maintenance, FP&C, UH Access Control Shop, and UH Access manager before being discarded. All small parts shall be bagged and attached to the correct door/part.
- i. Special design for Student Housing. All common doors and community used space such as laundry, exercise, kitchens, and/or game rooms) shall have on-line hardwired card reader systems. Private space may be design to utilize Off-line hotel style function access control locks. Although wireless on-line locks maybe a more accommodating design. All other doors shall meet with all other design guild lines.
- j. Specifications for electrified security locks must be reviewed and approved by UH Facility Management and The Electronic Access Control Manager. All electrified hardware will be coordinated with the “Cougar Card” system and shall integrate with the campus wide access control system.
 - i. All new classroom doors shall be equipped with electrified hardware and a minimum of one (1) card access lock with key override, which can be opened and secured electronically from the DPS Communications Center. Card reader shall be set up on “first card unlock.” All egress only doors from the classrooms shall have door position and REX function for monitoring in BASIS.
 - ii. All residential buildings shall have card access doors with key override at the following locations: Interior ingress/egress doors, building living/common areas (including laundry and fitness rooms, etc.), first

floor elevators, first floor doors connecting public space to bedroom wings, first floor stairwell doors, upper floor common areas (such as computer rooms, fitness areas, and computer rooms), doors leading into bedroom suites, and individual bedroom doors. Hallway doors leading into single residential rooms will also be equipped with card access locks. Card access hardware shall not include keypads. Hotel style function off-line card reader may be used on bedrooms and suite doors leading to bedrooms.

- iii. Research areas shall have at their primary entries card access doors with key override. Within the research area, electrified hardware and readers shall only be installed on doors that have high security concerns.
- iv. Clinical treatment areas shall have card access doors with key override.
- v. Pharmacies and pharmaceutical storage areas shall have card access doors with key override.
- vi. Administrative/office suite doors shall have card access with key override to enter the suite. Individual offices inside the suite and off public hallways will not have card access unless there is a need for accountability of access or a large number of users needing access.
- vii. MDF, IDF, and Mechanical/Electrical Rooms shall have card access doors with key override.
- viii. Double leaf doors and that are electrified and used for public ingress to the facility will have all leaves electrified.

8. Automatic Doors (ADO)

- a. Automatic operating doors may be sliding or swinging, as appropriate to the building use and design, with safeguards and handicapped accessibility as necessary. Door types, materials, hardware, and sensors shall be established designs with proven field experience under similar usage. Preferred manufacturers are Horton for swinging doors, and Stanley or Record USA for sliding doors. Consideration shall be given to availability of trained service technicians and spare parts.
- b. Automatic doors are preferred in high traffic areas.

9. Finishes

- a. Door trim and hardware finish color shall match existing hardware (levers lock, etc.) in building.
- b. All door handles shall be "P" handle type or return type.
- c. All new finish hardware to be Satin Finish. Do not use polished finishes.

10. Approved Hardware

- a. Mortise deadbolts must be Sargent and must conform to fire/life safety code. Interior handle must retract deadbolt in one action. All machine rooms, custodial closets, telephone rooms, elevator machine rooms, mechanical rooms,

and electrical rooms must have door closers and self-relocking. (Storeroom Function).

- b. Use Sargent 80 Series or comparable Von Duprin exit devices (panic hardware). Custom panic devices are not allowed. Do not use concealed vertical rods for panic hardware.
- c. Surface vertical rods are permitted. Single Point latching panic bars should be first choice of design and where applicable. Allow space between the door head and the ceiling for maintenance and repair.
- d. Avoid use of active/inactive leaf doors with coordinators when other hardware can be used to meet fire codes. Key removable mullions acceptable.
- e. Kick plates shall be specified for inside of interiors doors where trash, push, tool carts are utilized.
- f. Use floor mounted doorstops to prevent wall damage.
- g. All Panic Devise should be mounted to each door utilizing the through-bolting method wherever applicable. End Caps and covers must be secured to the brace with security screws.
- h. Classroom door maybe equipped with a manual lock down deadbolt that can be utilized in the event of emergence from inside the room by the turn a thumb turn on the lock. Egressing the space can always be done by pressing or turning the inside door knob/lever. Single action only. Access to this space will be accomplished by key when deadbolt is activated. Deadbolt can also be unlocked with the inside thumb turn. Due to design card access system will be de-activated if deadbolt is activated.
- i. Contractor to purchase Best lock cylinders and combined cores to be delivered to UH Access Shop.
- j. New construction projects, Best will deliver lock cylinders and combined cores to the UH Access Shop. Keyway requirements for lock cylinders will be determined by Best and UH for each building and coordinated with UH Access Shop.

11. Rollup doors

- a. **In Development**

12. Electrical Rooms and Electrical Vaults

- a. All electrical rooms shall have a panic bar and a panic bar through all other exiting door(s) where an injured person may receive rescue. Door(s) shall be fire rated for 1 ½ hours.
- b. All high voltage vaults shall have a panic bar and a panic bar through all other exiting door(s) where an injured person may receive rescue. Door(s) shall be "labeled" fire rated for 3 hours.

C1030 ACCESS CONTROLLED EGRESS DOORS

1. Doors in the means of egress shall be permitted to be equipped with an approved entrance and egress access control system, if the following criteria are met.
 - a. Sensor release devices: A sensor shall be provided on the egress side and arranged to detect an occupant approaching the doors, and the doors shall be arranged to unlock in the direction of egress upon detection of an approaching occupant or loss of power to the sensor. Sensor release devices must be used in conjunction with a panic bar.
 - b. Manual release devices: Doors shall be arranged to unlock in the direction of egress from a manual release device located 40 in. to 48 in. (102 cm to 122 cm) vertically above the floor and within 5 ft. (1.5m) of the secured doors. The manual release device shall be readily accessible and clearly identified by a sign that reads as follows: **PUSH TO EXIT**. When operated, the manual release device shall result in direct interruption of power to the lock-independent of the access control system electronics, and the door shall remain unlocked for not less than 30 seconds.
 - c. Activation of the building fire-protective signaling system, if provided, shall automatically unlock the doors in the direction of egress, and the doors shall remain unlocked until the fire-protective signaling system has been manually reset.
 - d. Loss of power to the part of the access control system that locks the doors shall automatically unlock the doors in the direction of egress.

C1040 INTERIOR GRAPHICS

1. Refer to SECTION 10.0 WAYFINDING STANDARDS, 10.2 INTERIOR SIGNAGE.
2. Final room numbers are to be assigned to the rooms on all documents from the beginning of the project. The room numbering procedure recommended by the Texas Higher Education Coordinating Board will be used. FP&C must approve the room numbering plan. Refer to Section C1000.

C1050 ACCESSORY REQUIREMENTS

Refer to SECTION 8.0 SPACE STANDARDS AND GUIDELINES.

CUSTODIAL CLOSETS (ON EACH FLOOR)

1. Locate sink near door. Use receptor/floor sink with 12 inch high sides and splash guard 24" above sink.
2. Provide six mop hangers above the mop sink. Provide six broom hangers along one wall.
3. Provide on one wall four 12" deep shelves mounted 18" apart with the bottom shelf two feet above floor.

4. Provide above broom hangers two shelves with one located 52 inches above the floor and the second located 72 inches above the floor.
5. Provide a three foot (3') wide door opening outward into the corridor. Provide custodial master lock established for campus.

CUSTODIAL STORAGE ROOM

1. A storage room is to be 8'x12'. Do not locate storage room next to trash room.

TRASH ROOM

1. Trash rooms shall not be provided in classroom and office buildings due to problems with odors and pest infestation.

RECYCLING ROOMS (ON EACH FLOOR)

1. A recycling room for storage of recyclable materials is to be a minimum of 8'x8'. Locate adjacent to or close to the Custodial Closet.
2. New construction shall include on each floor recycling alcoves sized to enclose a minimum 96 gallon size wheeled recycling container. Recycling alcoves shall be coded X041 for incorporation into sustainability metrics. Recycling alcoves may not be located along egress corridors for the following reasons: Recycling bins in an alcove in an exit corridor do not meet code for the following reasons: bins are light and can be moved, when bins are full occupants will continue to pile recyclables in and around the bins obstructing egress; and were the bin to catch fire it would produce enough smoke and heat to prevent occupants access to, egress from, or visibility of the means of egress.

CUSTODIAL REQUIREMENTS FOR OFFICES AND CLASSROOMS

1. For office trash receptacles, use SAFCO SAF-9616 BL.
2. For Classroom trash receptacles, use SAFCO SAF-9618 BL.

ATTIC STOCK ROOM

1. Provide an attic stock room (minimum 8' x 8' in size) for storage of maintenance or replacement finish materials. Locate adjacent to or close to Custodial Storage or main mechanical room.

C1060 REST ROOMS

1. In all permanent buildings, toilet partitions or stalls should be floor-mounted with continuous head rail and shall be of phenolic or textured stainless steel construction. Partition panels shall fasten at wall with a full height "U"-bracket. Provide coat hook and bumper guard on back of each toilet partition door. Lever door hardware is required in handicapped-accessible stalls and preferred in all stalls. Specify all fittings as stainless steel for long-lasting quality.
2. Floor-mounted toilet stalls of metal with epoxy paint may be used in low usage areas. Provide combination hook and coat hook/bumper inside.
3. Where showers are provided, shower walls shall be masonry with ceramic tile finish. Shower pans shall be prefabricated lead; no rubber pans will be allowed.
4. Minimum size of ceramic wall tile to be 4-1/4" x 4-1/4". Light shades of tile should be selected for both floors and walls.
- ~~5.~~ Sanitary napkin receptacles are required in each water closet enclosure or stall in women's toilet room.
6. Mirrors above ganged lavatories shall be full width of the lavatory installation.
7. Mirrors above single lavatories generally shall be 20" x 26" first quality plate glass mirror with chromium-plated brass or stainless steel frame and a 4 inches deep shelf, zinc coated pan backs, and theft-proof concealed mounting.
8. Lavatory counters are to be granite or Corian with self-rimming counter top sinks. Counters must be handicapped accessible. Install soap dispensers to drip into sinks.
9. Coordinate with FP&C regarding the current toilet tissue holder specification.
10. Sanitary napkin receptacle to be United Receptacle URI-13.
11. Hand dryers shall be Xlerator Model XL-SB. Paper towel dispensers shall not be installed in new construction and/or renovation projects. The use of rubber floor mats below hand dryers is required at all locations. Contact the FPC or FS project manager for standard mat information to be provided by the project on new installations. Locate hand dryers close to sinks to reduce the water drip trail from the sink to the dryer.
12. Use Buckeye International Symmetry hand soap dispenser (Smoke color w/sym logo).
13. On the first floor of every building on campus, one public men's room and one public women's rest room shall feature an approved Sharps disposal container. Contact the FPC or FS project manager for further information on the container and signage requirements.

14. FP&C/FM-approved substitutes may be used for above accessories.
15. Provide floor drains in each toilet room near water closets and slope floor to drain. Provide one floor drain in each accessible stall.

C1062 INDIVIDUAL OCCUPANT REST ROOMS

Rest room facilities on the lowest floor of public buildings shall include a single occupancy rest room sized to be fully accessible to a wheelchair-dependent user and attendant. The single occupancy rest rooms do not require toilet/urinal partitions but otherwise shall be furnished with fixtures and accessories as directed in C1060. The rest room shall also include a diaper changing station.

C1065 LACTATION ROOMS

The University of Houston wishes to support students, staff, and faculty who are new mothers and who wish to breastfeed their babies; to that end the University has provided multiple lactation rooms across campus to meet the needs of nursing mothers. Design consultants shall consult with FP&C, the Women's Resource Center Director, and the building user regarding whether incorporation of a lactation room in planned remodeling or new construction enhances the lactation room program or is unnecessary due to an existing nearby location.

Design consultants shall refer to AIA Best Practices on Lactation Room Design for relevant planning guidelines.

C1070 BULLETIN BOARDS, TACK BOARDS, CHALK AND WRITE BOARDS

1. Directory and bulletin board location, size, and style must be approved by the FP&C Project Manager.
2. Use mechanical fasteners to mount marker and other type graphic boards to walls.
3. Provide chalkboards and/or white boards in all classrooms and conference rooms.
4. White boards are to be of three component type with porcelain enamel on 24 gauge steel face with rigid core and aluminum sheet backing. Finish shall be high gloss and shall be easily cleanable with dry cloth or standard eraser.
5. Provide bulletin boards and tack boards adjacent to administrative offices.

C20 STAIRS

C2000 GENERAL

C2010 STAIR CONSTRUCTION

1. Stairs used only for exiting will be designed to code and NFPA 101 requirements.

2. Stairs used for exiting but also used for student movement will be oversized or widened to accommodate the peak student loads.
3. Stairs used for students should use oversized structure and heavier gauge materials to reduce noise and vibration.

C2020 STAIR FINISHES AND FITTINGS

1. Fire exit stairs may have minimum finish requirement.
 - a. Student-used stairs will have rubber treads and landings to reduce impact noise. On stair treads wider than six feet no piece of rubber tread shall be less than one-third the tread width.
 - b. Student-used stairs will be brightly lighted and will use upgraded building finishes.
 - c. Provide acoustical treatment at all stair ceilings and on the underside of landings.
2. Handrails
 - a. Handrail simple and compound curves shall be formed by bending members in jigs to produce uniform curvature for each repetitive configuration required. Cylindrical cross section of member shall be maintained throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
 - b. The University of Houston Fire Marshal's Office enforces NFPA 101-7.2.2.4.2; Continuity: Required guards and handrails shall continue for the full length of each flight of stairs. At turns of new stairs, inside handrails shall be continuous between flights at landings."
 - c. Anchors and inserts as required to support work specified, in accordance with approved shop drawings. If required, provide reinforcement to meet loading criteria.
 - d. Depending on occupancy type, the handrail configuration may require, by code, a minimum finger recess.

C30 INTERIOR FINISHES

C3000 GENERAL

C3010 WALL FINISHES

1. In lobbies and major traffic corridors use durable, easily maintained materials such as stone, masonry, metal or plastic laminate. In unusually high-traffic areas, Scuffmaster Armor or Scrubmaster paint may also be considered.

2. In auditoriums and large classrooms use plastic laminate wainscot with stretched fabric acoustic panels above.
3. In all low-wear area, paints shall typically be non-VOC formulation
4. In classrooms, offices and corridors use semi-gloss or eggshell paint. Paint must be water-based unless exceptions are approved by FP&C/FM. High gloss and flat paints are not allowed. Paint shall be ICI, Sherwin-Williams, or UH Paint Shop approved equal.
5. Do not use vinyl wall coverings unless FP&C/FM approval is obtained prior to design. The use of vinyl wall covering is not allowed on the interior surface of exterior walls.
6. Off-white and accent paint color standards: At the conclusion of construction and renovation projects, large quantities of unused paint are left for disposal. Standardizing on a palette of off-white and accent color allows FPC/FS to combine remainder quantities and donate to UH departments or to non-profit organizations. Contact your FPC or FS Project Manager for the approved interior paint palette.
7. Do not use multi-colored enamels.
8. Refer to the appropriate sections for finishes in restrooms, stairs, janitor closets, electrical and telecommunications rooms.
9. Use corner guards on exterior corners of corridor walls and similar heavy traffic areas. Wall bumpers and corner guards are required adjacent to service elevators and loading docks.
10. In mechanical rooms apply a coat of paint to all surfaces that do not already have a finish coat of paint, such as pumps and motors. Vinyl-faced fiberglass panels installed to the ceiling and walls are recommended for acoustical absorption.
11. All renovation projects require UH Paint Shop approval of surface preparations before repainting.
12. UH Paint Shop must approve painting specifications.

C3020 FLOOR FINISHES

1. Provide walk-off mats or walk-off carpet tile at all entry vestibules.
2. Provide terrazzo, terrazzo tile, stone or porcelain flooring for all ground level entry lobbies and major traffic corridors.
3. Use stone or terrazzo base with stone or terrazzo floor.

4. Provide VCT for all high use areas that need hard flooring
5. Resilient tile floors (VCT): University standard thickness is 1/8 inch minimum.
6. Modular carpet shall be used for all carpet installations. Only broadloom may be used in office suites and other areas as approved by FPC/FM.
7. Carpet pads may be considered for deans' and executives' offices as approved by FPC/FM.
8. All rubber base to be 4" cove base at hard flooring and 4" straight base on carpet. Black-Brown is the preferred color option. FPC must approve any other color.
9. Use padded carpet in deans' and executives' offices as approved by FPC/FM.
10. Carpet tile may be used in classrooms and office areas as approved by FPC/FM.
11. Use stone or terrazzo base with stone or terrazzo floor.
12. All other base to be 4" black rubber cove base.
13. Mechanical room floor shall typically be sealed concrete for dust control. All exposed concrete is to be sealed. Mechanical rooms above occupied space shall have a sealed and watertight floor. The wall finish shall also be sealed and watertight for a minimum of four inches measuring from the floor. Four inch high concrete curbs are strongly recommended in mechanical rooms.
14. Custodial room floors shall be sealed concrete only.
15. Resilient tile floors (VCT and rubber): University standard thickness 1/8 inch minimum.
16. Seamless flooring is not encouraged except in laboratory and food service areas, as appropriate. Obtain approval by FPC/FM before use.
17. Computer flooring: 3 inch or 6 inch computer flooring may be applicable in server rooms and offices supporting computer labs. Ramps are not allowed. Recess the structure to obtain level transitions.
18. Wood flooring is not encouraged.
19. Laboratory floor finishes (all floors must be sealed to prevent leakage to lower floors):

Instructional labs flooring shall be VCT.
Research lab flooring for chemistry, physics, and engineering shall be VCT.
Research lab flooring for biology shall be monolithic, seamless, chemical-resistant vinyl flooring with integral coved based and mylar finish.

Greenhouse and animal holding flooring shall be monolithic epoxy resin.
Sealed concrete may be considered for alternate lab and storage area flooring.

C3030 CEILING FINISHES

1. All mechanical and electrical devices located above the ceiling must be accessible through a lay-in ceiling or access panels.
2. Ceilings of high humidity rooms will be plaster, drywall or plastic-clad lay-in panels.
3. Partitions will penetrate lay-in ceilings unless approved by FP&C.
4. Acoustical lay-in ceiling shall be 2 feet by 2 feet grid. Wire hangers shall be 12 gauge steel at four feet on center minimum. The hangers shall be wrapped tightly with three full turns.
5. Gypsum plaster ceilings will be limited to entry lobbies, decorative ceilings for auditoriums, and large conference rooms.
6. Fabric covered insulated panels may be used in auditoriums for acoustical control when installed to a taped and floated suspended drywall ceiling.
7. Drywall ceilings will be 5/8" fire-rated gypsum board on suspended 25 gauge metal studs at 16 inches on center.
8. Projector screens, and projector platforms will have independent support and will not bear on the ceiling framing system.

ELEMENT D

SERVICES

D10 CONVEYING

D1000 GENERAL

D1010 ELEVATORS AND LIFTS

The American Society of Mechanical Engineers/American National Standards Institute safety code for elevators, dumbwaiters and escalators, and moving walks, A17.1, latest edition shall be used in the selection and design. Elevators shall comply with current provisions of the Texas Department of Licensing and Regulations Architectural Barriers Texas Accessibility Standards and the Americans for Disabilities Act ("ADA") Accessibility Guidelines.

1. All elevator acceptance testing, including load test, is to be witnessed and approved by UH elevator maintenance staff.
2. The elevator vendor must include required training in the cost of the elevator and describe what training will be provided. Two complete sets of maintenance manuals are required. No proprietary special tools are allowed for elevator maintenance
3. Elevator controls for all elevators shall be Virginia Controls, Motion Control Engineering controls, or SmartRise controls only. Proprietary controller can be installed only if a non-proprietary compatible (Virginia, Motion, or SmartRise) controller is provided to Elevator maintenance staff. Any additional components necessary to the removal of the proprietary controller and installation of the non-proprietary controller shall be provided to the elevator maintenance staff.
4. All elevators shall have remote monitoring capability in the controllers.
5. The elevator vendor must provide a priced spare parts list with prices good for at least three years after warranty period. Vendor must indicate availability of spare parts.
6. Elevator controls to have fire alarm panel control input for Fireman's Service-Phase I Recall to main entrance floor.
6. Elevator shafts are to be ventilated, but not excessively so that door operating problems result. Sump pumps are required in the pits.
7. Each elevator pit is required to have an access ladder, light, and duplex 120volt GFCI receptacle. The switch for the light is to be located at the top of the ladder. Provide sump pit, sump pump with piping to adjacent elevator door and movable 55-gallons barrel.
8. Each elevator car top is to have a trouble light and duplex 120 volt GFCI receptacle.
9. Design elevator installations to comply with ADA. Specify directional (up or down) arrows above each door on the lobby side and provide gong or chimes.
10. Provide ADA-compliant emergency telephone system for each elevator in accordance with the following specifications:
 - a. One flush-mounted telephone: TALK-A-PHONE ETP-100EB
 - b. One ADA nameplate set.
 - c. One Rolm telephone adapter.
 - d. One analog telephone pair terminated in an RJ-11 jack and located near the elevator traveling cable at the telephone is required.
 - e. One telephone pair in elevator traveling cable and one assigned elevator telephone number from UH telecommunications from 48 volt analog board are required.

13. Electric operated elevators are preferred; however, oil hydraulic operation may be considered where use is intermittent or where elevator serves three or fewer floors.
 - a. Hole-less technology shall be used for hydraulic elevators.
 - b. Hydraulic elevators shall be equipped with a submersible pump and power pack to lower cars to egress floor.
 - c. Elevator shafts with the potential for hydraulic fluid leaks shall have secondary containment as a built-in feature to prevent releases of fluid into the ground.
14. Machine-room-less elevators are not allowed.
15. Hydraulic elevators proposed for open buildings such as parking garages high traffic use shall have oil cooling units provided for each elevator.

PASSENGER ELEVATORS

Speed:	2 through 3 floors travel of 150 ft./min.; 4 and above floors travel of 350 ft./min.;
Capacity:	Generally, capable of holding an EMS stretcher and a load rating of 2500 to 3500 pounds are specified depending on floor area and person density.
Control:	Selective/collective automatic for single cars. For multiple units of two or more, group automatic control. Solid state controls preferred. Virginia Controls only.
Operation:	Leveling with resistance operation through 150 ft./min.; solid state control for 200 ft./min. and above.
Cab:	All cab interiors shall feature stainless steel front car door, stainless steel base, luminous ceiling with UL approved, recessed LED lighting, exhaust fan, stainless steel handrails on three sides, steel toe rail where heavy cart or furniture moving is anticipated, telephone for voice communication to meet handicapped requirements. Floor and wall panel finishes vary by quality level. See UH Project Manager for standard elevator palette specifications.
Utility level finish utility cab	textured stainless steel wall panels per palette specifications, commercial quality diamond steel floor plate flooring

Lowest level finish:

passenger cab	Continuous full height plastic laminate panels, 3/16" terrazzo tile floor, all per palette specifications. Suggested for short-duration installations.
Standard level finish	
passenger cab	Plastic laminate panels above handrail height, textured stainless steel wall panels below handrail height, 3/16" terrazzo tile floor: all per palette specifications.
Upper end level finish	
passenger cab	Textured stainless steel wall panels above and below handrail height, 3/16" terrazzo tile floor: all per palette specifications.
Hoist way Entrances:	3'-6" min. width, 7'-0" high, baked enamel finish, power operation. Entrances shall be constructed of 16 gauge material.
Machine Location:	
Electric Elevators: Overhead preferred, but location at lower level optional on installations of four floors and less.	
Oil Hydraulic Elevators:	Not above first floor; adjacent to hoist way preferred.
Platform:	Size according to code for capacity; however, standard sizes should be selected.
Signals:	Provide EPCO Door open bell, in-use light and illuminating buttons, EPCO braille markings on car operating face plate and call signals. One emergency alarm bell button in each car shall be connected to emergency alarm station at main floor.
Flooring:	Same as adjacent area by flooring subcontractor.
Floor Lockout Provisions:	Provisions shall be included if directed by FP&C.
Emergency Power:	Interlock with emergency generator if Emergency Power System is approved for building. At least one elevator in each building must operate on emergency power. Hydraulic elevators shall have switchable selection for emergency service.
Hooks & Pads:	Hooks shall be installed in all passenger elevators. In addition, one complete set of pads shall be furnished for the Owners' use after construction.

SERVICE ELEVATORS (Freight only)

Speed:	Up to and including 2 floors travel of 50 ft./min.; above 2 floors travel 100 ft./min.
Capacity:	Minimum of 4000 pounds; however, product and product weight should be considered.
Control:	Same as for passenger elevator operation except for a 2- floors installation a single automatic pushbutton will be acceptable.
Operation:	Same as passenger service.
Cab:	Standard freight (steel wainscoting) 8' high x 8' deep. Freight elevators are to be provided with complete set of wall protection pads.
Hoistway/Entrances:	Bi-parting type. Generally, door operation is manual; however, consideration should be given to power operation where use of equipment is extensive. Freight elevators are to have horizontal center opening doors. Freight elevator cabs are to be specified in detail. Entrances shall be constructed of 16 gauge material.
Signals:	EPCO Door open bell, in-use light and illuminating buttons.
Machine Locations:	Same as passenger elevators.
Platform:	Size and classification according to code, building requirements, and capacity.

D20 UTILITY PIPING SYSTEMS

D2000 GENERAL

1. Pipes penetrating exterior walls below grade must be properly installed to prevent breakage due to building settlement or expansive soil.
2. All connections to campus distribution systems or public utilities shall be precisely located by dimension or coordinates and documented on "as built" drawings. Depth of piping shall be shown and inverts will be shown at manholes and other critical points.
3. Drop type entries shall be utilized per acceptable standards.
4. Access shall be provided to all working parts of plumbing devices. Do not permanently seal in wall any plumbing items requiring periodic operation or maintenance.
5. Provide 30 inch diameter minimum size access openings for all manholes.

6. Interior cleanouts shall be located at each bend and every 50 ft. in straight runs. Access panels (9" x 9" minimum) shall be provided at all cleanouts. Exterior cleanouts shall be located at every 90 ft in straight runs and shall be provided with a marked cover.
7. Consideration shall be given for easy access to grease traps, which must be serviced regularly.
8. New buildings constructed with campus tunnel access should allow for air-conditioning condensate recovery thru dedicated lines with venting where necessary.

D2010 PLUMBING FIXTURES

1. Provide custodial closets with receptor/floor sink with 12 inch high sides located near door.
2. In renovation projects, replacement fixtures shall match the manufacturer, style, rough-in, and mounting of existing fixtures.
3. In phased projects, fixtures installed in later phases shall match the manufacturer, style, rough-in, and mounting of fixtures installed in the first phase.
4. All urinals and water closets shall be wall mounted on fixture chairs attached to the floor.
5. Drinking fountains shall be electric, wall type, surface mounted in wall recess. Mount all bubbler spouts 36" above finished floor to meet handicapped requirements. Where two (2) fountains are mounted side by side, they shall be mounted at different heights, one for handicap, and one standard. Provide bottle-filler style water fountains at all first floor electric drinking fountain installations.
6. Fixtures with enhanced water –saving characteristics may be considered for LEED-certified project. Contact the UH project manager for details.
7. AirJet Showerheads (281-859-9888) are the standard for campus showerheads.
8. No hub couplings, pipe, and fittings are not allowed.
9. Plant Operations preferred plumbing fixture manufacturers: see Master Construction Specification Section 22 30 00 Plumbing Fixtures.

D2010.90 EMERGENCY SHOWER & EMERGENCY SHOWER/EYE WASH COMBINATION UNITS

1. Emergency showers and emergency shower/eye wash combination stations shall be located so that an individual should be able to access them within 10 seconds. Floor drains shall not be provided. Each station shall be provided with a flow switch tied into the SimplexGrinnell's controls and network system and reporting to DPS and the Fire Alarm Shop as a priority 2 alarm.

D2015 PIPE INSULATION

1. All water piping insulation to be closed cell type (cellular glass or polyethylene).
2. Air handler condensate drain lines to be insulated along their entire length with Armaflex or equal.
3. Domestic cold and hot water lines are to be insulated.
4. Protective aluminum jacket required for pipe insulation in mechanical rooms.
5. Insulation joints to be sealed to prevent air and moisture absorptions.
6. Steam and condensate piping to be hydrous calcium silicate ASTM C533. Install with 16 gauge stainless steel tie wire or stainless banding on 9 inch centers with twisted ends.
7. Insulation thickness for steam piping: 1 ½ inches for pipe size up to 4 inch and 2 inches for pipe 4 inch and larger.
8. Jacketing: Aluminum jacketing 0.016 inch minimum thickness; stucco embossed with moisture barrier attached; longitudinal slip joints and 2 inch laps; aluminum or stainless steel metal jacket bands ½ inch wide and 0.015 thick minimum. All butt joints to be sealed with silicone. Manufactured fitting covers shall be used for all fittings.
9. Shields for insulation support at pipe hangers to be Grinnell Figure 167 or equal approved by FP&C. Shields must be attached to hanger or to the insulation jacket so as to not be able to fall.
10. All insulation material must be certified to be asbestos free.

D2020 DOMESTIC WATER DISTRIBUTION

1. General
 - a. Building HVAC design must comply with the latest revisions of the Energy Conservation Design Standard for New State Buildings. Project Architect and Project Engineer shall prepare and submit forms for compliance verification.
 - b. Solar water heating should be considered as either the primary or supplemental domestic potable water heating source.
 - c. All piping installations must be in accordance with B31.9 and other applicable codes and standards. Pipe welds must be visually inspected by inspectors assigned by FP&C.
 - d. Backflow preventers must be installed in make-up water lines.
 - e. The following requirements are typical for low pressure service for HVAC and domestic water service. Applicable ASME codes will apply for high pressure steam or gas.

2. Valves
 - a. Ball valves should be used for 2 inch and smaller piping systems.
 - b. When valves are insulated, valves shall have valve stem extensions if required to position operating handle without damaging the insulation.
 - c. Gate valves are to be rising stem and chilled water system valves 6 inches or larger are to have gear type operators.

3. Water and Steam Piping
 - a. Refer to Master Specifications for supply, steam, and condensate piping criteria.
 - b. Copper pipe shall not be used underground or in concrete,
 - c. All solder and brazing materials must be lead free.
 - d. Victaulic ring groove connections can be used for above ground copper pipe connections 2 ½ inch and larger.
 - e. Dielectric unions must be used at all iron to copper pipe connections.
 - f. Water hammer arresters are to be Watts or approved equal by FP&C.
 - g. Automatic air vents are to be installed in all water lines at the high point of the distribution system on each floor and at the high point service connections at air handlers and other equipment.
 - h. Automatic air vents shall have ¼ inch IPS inlet connection and 3/8 inch outlet connection. Each air vent must have a 3/8 inch Type L copper tube discharge line routed from the air vent to the nearest floor drain. A ¾ inch threaded ball valve shall be installed at the inlet to the automatic air vent to permit air vent maintenance.
 - i. All riser and branch lines shall have isolation valves to permit equipment and equipment isolation valve maintenance without having to drain the water distribution system upstream of the maintenance point. Isolation valves shall be located at each floor riser, at the intersection between wings of floors, and at point of entry to rest rooms. Appropriate signage shall be posted.
 - j. Drain connections with threaded ball valves shall be installed downstream of each isolation valve at the low point in the line to permit draining of water lines. 2 inch and larger lines shall have a minimum ¾ inch drain connection and valve. Smaller lines shall have a ½ inch drain connection and valve. A threaded pipe plug shall be installed in the outlet of each drain valve.
 - k. Keyed hose bibs shall be provided on 100ft maximum centers around the outside of the building.
 - l. In tunnel installations, pipe hangers and shock absorbers shall be added to pipe runs.
 - m. At every floor penetration a cast in sleeve or other monolithic curbing at least 2 inches high must be provided to help contain water spills or leaks.
 - n. Branch connections from pipe headers must be from the top of the pipe header.
 - o. Design operating temperatures and pressures are to be shown on construction drawings.
 - p. Metal braided flexible pipe connections are required for pump suction and discharge connections 2 inches and larger.

- q. Pipe supports to be installed as required to prevent pipe loads being supported at equipment connections.
- r. Leak testing of piping systems must be at 1 ½ times system design working pressure and leak testing witnessed by staff assigned by FP&C. Leak testing to be done and accepted prior to insulation of pipe.
- s. Piping should not be installed under concrete slabs without prior approval by FP&C.
- t. Piping system branch connections must use weld or threaded fittings. This requirement applies to instrument connections also.
- u. Thermometer wells and thermometers are required for all air handler supply and return lines 1 ½ inch and larger. Pete's plugs are to be installed in all air handler supply and return water lines.
- v. The Main Campus Central Plant steam supply pressure to the tunnel distribution system has a design maximum of 125 psig, but 75 psig steam pressure is typical for normal operations.
- w. Condensate return pressure at the Central Plant is 30 psig. Provide pumped condensate return to the tunnel condensate return system.
- x. Confirm water metering need with FP&C Project Manager. Electric meters are the top priority for project inclusion, followed by water, chilled water, and steam meters. Auxiliary buildings will be the highest priority for meter location, followed by science and research buildings, followed by E&G buildings 40,000 SF and larger. Water meter basis of design is ONICON Model F-1200 Dual Turbine Flow Meter (and BTU management system) featuring patented non-magnetic impedance sensing method, low-mass non-metallic turbines with sapphire jewel bearings and tungsten carbide shafts providing an extremely long-wearing mechanical system.
- y. Confirm steam metering need with FP&C Project Manager. Electric meters are the top priority for project inclusion, followed by water, chilled water, and steam meters. Auxiliary buildings will be the highest priority for meter location, followed by science and research buildings, followed by E&G buildings 40,000 SF and larger. Steam meter basis of design is the Onicon F-2500 Series Vortex Flow Meter. Operating as a loop powered device, each F-2500 meter provides a 4 - 20 mA output signal for flow rate and a scalable pulse output. Built-in display provides flow rate and total data, instantaneous temperature, operating status and diagnostic data.
- z. All steam and condensate piping 2 inch and larger shall be welded with flanged connections.
 - aa. Steam piping is to be sloped downward in direction of flow with drip legs and steam traps installed to keep condensate from collecting in the piping when steam is flowing.
 - bb. Condensate return piping is to be sloped downward in direction of flow.
 - cc. Install strainers with blowdown connections in steam lines upstream of control valves and steam traps. Blowdown valve and line shall be ½ inch for lines smaller than 2 inch and ¾ inch for 2 inch and larger.

- dd. Upstream and downstream isolation valves shall be installed for each strainer and control valve or strainer and steam trap installation.
 - ee. Provisions for venting and draining steam and condensate lines are required.
4. Gas Piping
- a. All gas piping 2 inch and larger shall be welded. Screwed fittings are permitted for above ground piping smaller than 2 inch except that screwed piping may not be used in chases. Provide a schedule 10 black iron pipe sleeve to completely enclose the gas pipe throughout all chases and concealed areas of the building. The sleeve shall be vented to atmosphere at the top of the building.
 - c. Gas stop valves must be provided for each piece of equipment. Valves 2 inch and smaller shall be lubricated ported plug valves (Mueller or approved equal) AGA or UL approved. Valves 2 ½ inch and larger must be certified for natural gas service.
 - d. All gas piping must be pressure tested for 24 hours and the test witnessed and accepted by staff assigned by FP&C.

D2030 SANITARY WASTE

- 1. Provide floor drains near sinks and in each restroom with floor sloped to drain openings.
- 2. Floor drains are also required in all mechanical rooms, fire pump rooms, laundry rooms and plumbing chase areas and must be accessible with floor sloping to drains.
- 3. All floor drains will have trap primers or for infrequently used drains, drainage alternatives such as Trap Guard.

D2040 RAIN WATER DRAINAGE

- 1. Roof overflow drains are discouraged. Roof overflow scuppers are preferred. Refer to Section B3010.9.
- 2. Insulate all storm drains that run through conditioned spaces. Insulation may be discontinued after one floor.
- 3. Roof drains shall be run separately from all other storm water sources to outside of the building.

D30 HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

D3000 GENERAL

- 1. Exhaust stacks for such equipment as laboratory hoods shall be designed to emit at the highest point away from the new structure, and in particular away from fresh air

intakes. Additionally, care shall be taken to consider patterns of air flow and emissions as they relate to the surrounding buildings.

2. In phased projects, motors, fans, coils, pumps, and filters installed in later phases shall match the manufacturer, style, rough-in, and mounting of similar components installed in the first phase.

D3005 MECHANICAL EQUIPMENT ROOMS

1. Mechanical Rooms shall be sized to allow for equipment maintenance and replacement.
2. Stack mechanical rooms vertically in the building.
3. Access to equipment rooms shall be direct from hallways. Do not provide entrance through other rooms.
4. Walls of equipment rooms, when located on occupied floors shall be sound proofed and return air passages shall utilize sound attenuation boxes.
5. Provide a 4" high curb around duct, pipe, conduit, etc. penetrations through the floor when occupied space is on the floor below. All penetrations shall be sealed with fire proof material.
6. Depress floor 1-1/2"± at walls and uniformly slope entire floor to floor drain(s) 1/16" per foot.
7. Provide lifting eyes in mechanical rooms as required for heavy equipment maintenance.
8. Provide housekeeping pads for equipment.
9. Ventilate under floor areas.
10. Freight elevator access from mechanical rooms is required to move heavy equipment between ground floors and other floors.

D3010 ENERGY SUPPLY

1. Buildings constructed within the campus core will be connected to the existing campus utility tunnel as determined by UH Utility Services and will receive chilled water and steam from the Central Plant.
2. Chilled water is supplied to building at 45 deg F.
3. Steam is supplied at 75 psig saturated.
4. Condensate return units are required to pump building condensate back to the Central Plant. The utility tunnel condensate return header pressure is about 80 psig.

5. Buildings having their own AC compressor units will be designed for 45 deg F chilled water supply temperature if eventual tie in to the Central Plant is planned.
6. Natural gas fired boilers installed on the UH campus that are rated at 2MM BTU maximum heat input and less; must comply with the requirements of 30 TAC 117 475 (controlling NOx emissions at a minor source in Harris County). Acceptable emission levels vary with the hp rating.
7. Any new steam boiler shall be the hi-efficiency, lo-NOx type (7 ppm max during startup testing), complete with flue gas heat recovery.
8. For boilers greater than 2 MM BTU pre-approval is required by the Environmental Health & Safety Department. These boilers must be equipped with NOx emission control devices. NOx control is defined as flue gas emissions not to exceed 30 ppm by volume at 3% oxygen, dry basis. Additional requirements include a fuel feed meter and boiler combustion shall be controlled with oxygen, CO or fuel trim.

D3040 AIR HANDLERS AND DUCTWORK

1. Built up air handlers shall have an air tight sectionalized casing construction of lock forming quality galvanized steel. Outer section to be 20 gauge sheet and 22 gauge inner sheet minimum with 2 inch 3 pound density insulation in between perforated metal wall. Non-perforated inside duct wall is required in chilled water coil duct section as described below. Galvanized metal shall not be painted; phosphatized or bonderized metal shall be finished with rust inhibiting paint. For maximum rigidity casing shall be properly reinforced and braced with steel angle framework with the same finish as casing. Casing shall consist of a fan section, a coil section or sections, and a continuously draining stainless steel drain pan. Suitable gaskets shall be provided at all joints between casing sections. Stiffeners shall be provided as required to prevent unit casing pulsations. The double wall non-perforated metal casing must extend downstream past the cooling coil at least three feet. Thermal break insulation is to be installed as required to prevent sweating on exterior surface of air handler casing.
2. The coil section of built up air handlers shall completely enclose all connections, coil headers, and return bends. Air seals for coil piping penetrations are to be installed.
3. Coil frames for built up air handlers shall be used as structural members of the coil section. The coil section shall be constructed in such a manner that the coils be removed without affecting the structural integrity of the casing. Coil frames shall be constructed of 304 stainless steel and shall have intermediate stiffeners if over 5 ft long.

4. Air handler coil condensate collecting drain pans shall extend under the complete coil section (at least 18 inches beyond coil) including access and plenum sections between multiple coils, and shall be rigid, watertight and sloped to drain continuously to prevent condensate build up in drain pan. The drain pan to have slope to ensure continuous condensate drainage with threaded pipe connections at low point of drain pan. Drain pan shall be of the double wall insulated type with a 304 stainless steel inner pan and a galvanized or stainless outer pan with tell-tale drain exposed. Pan insulation shall be 1 inch thick high density fiberglass closed cell cemented and vapor sealed between the inner and outer pan or ½ inch thick foamed in place closed cell insulation.
5. Built up air handler access doors, at least three-quarter of a square foot but no larger than six square feet in size, shall be furnished in the fan and coil sections to provide access to internal parts for maintenance. Doors whose smallest dimension is 12 inches or less shall be equipped with Amertoc 10 or Ventiok Style 100 latch, all other doors shall be equipped with Ventiok Style 140 latch and Ventiok Style 150 hinges (or equal manufactured by Amertoc and approved by FP&C). Doors shall be located so that the unit may be inspected or entered regardless of installation arrangement. Door installation shall be separate from unit insulation and shall be secured and sealed as specified for unit casing insulation. Access doors shall be located on the most accessible side of the air handling unit as it is installed.
6. If a chilled water rooftop unit (RTU) must supply air around the clock, it must have provisions to prevent coil freezing, including preheat capability for the designated volume of air thru the RTU.
7. Centrifugal fans shall be double width, double inlet, multi-blade type. Fans shall be fabricated of galvanized steel, all aluminum, or fabricated steel protected with two coats of rust inhibiting paint. The air handling unit fan rpm shall not exceed 600 rpm unless exceptions are approved by FP&C.
8. Fan shafts shall be of one piece solid construction. Diameter of shaft between stubs must not be reduced and stub shaft diameter to be the same at both ends.
9. Fan shafts shall have SKF, Sealmaster, Timken or Fafnir externally mounted grease lubricated self aligning ball bearings. Bearings shall be heavy duty and have an average service life of 200,000 hours. Life lubricated sealed bearings are not acceptable. Shafts with internally mounted bearings shall have grease lines extended with metallic tubing and shall be accessible from the drive side of the unit. In addition, the bearing on the drive side of the unit shall have grease line extended beyond the belt guard. All grease lines shall terminate in a zerk fitting.
10. Air handler coil tube shall not have more than 10 fins per inch or more than six rows of tubes per coil. Air handler coils must have accessible vents and drains.
11. Air handler coils must be tested at 1 ½ times design working pressure.

12. Air handler coils must have accessible vents and drains.
13. Air handler coils must be tested at 1 ½ times design working pressure.
14. Hot water heating coils may be installed in mechanical rooms only. Electric heaters must be used in other locations.
15. Chilled water coil face velocities shall not exceed 500 feet per minute.
16. Coil tube water velocities shall not exceed 6 feet per second or go below 2 feet per second.
17. Maximum allowable coil height is 54 inches.
18. Provide belt guards for all fan drives mounted outside the unit casing. Guards shall conform to the contour of the drive assembly. Material, construction, and finish of the guards shall be similar to that of the unit casing. Guards shall be braced and fastened so that objectionable vibration will not occur. Provide tachometer openings at least 2 inches in diameter for checking fan and motor speeds. The tachometer openings must be in line with shaft axis. Two section fan guards shall be designed in such a manner that either section can be removed without removing the adjacent section.
19. Air handler fan motors shall be mounted on the coil connection side. Motors are not to be mounted on top of the air handler. Motors shall be factory mounted on an adjustable base rigidly connected to the-vibration isolated frame.
20. Air handler filter holding frames shall be fabricated of 16 gauge galvanized steel equipped with tight fitting gaskets and suitable fasteners to accommodate 2 inch ASHRAE 35 percent-air filters. The fasteners shall be capable of being attached or removed without the use of tools.
21. Pre-filtering and filtering required for outdoor supply air handlers: Typically 4 inch 65 percent pleated filters for air handler filters on outside air units.
22. Contractor is not to operate air handlers without filters installed. Contractor to provide filters for use during construction phase of project and one complete set of filters to be installed by contractor at end of construction phase of the project. If Contractor operates air handlers without filters or properly installed filters, air handler coils and ductwork will be cleaned as required by FP&C/FM at no charge to the University.
23. Air handling equipment and ductwork must be kept protected during storage and the construction phase of the project to prevent water, dirt and trash getting into the inside of the air handling equipment and ductwork. If FP&C/FM inspection staff

determines that equipment or ductwork is not clean, the contractor will be required to do the necessary cleaning at no charge to the University.

24. Air handler installation must permit access for maintenance such as filter changing, coil and blower removal.
25. A secondary containment condensate collecting pan is required to catch condensate drain pan accidental overflow for all fan coil units installed at or above the ceiling. A tell-tale drain from the secondary drain pan is required to divert overflow to an area where the overflow can be seen without causing water damage to equipment or furnishings.
26. Ductwork shall be externally insulated. The use of angle iron to support insulated ductwork is recommended because it is easier to insulate the assembly.

Where unistrut is used at insulated ducts, the flat face of the unistrut channel typically shall be installed against the duct. Insulation blocking shall be required at the unistrut so that the rigid insulation is around the duct, the blocking is between the duct and the hanger, and the unistrut does not become part of the vapor seal.

In the case of the open side of the unistrut channel facing the duct, the open side of the unistrut shall be packed with insulation so that there is not an air void that can allow condensate migration. The wrap installed around the hanger and the vapor mastic shall be complete around the installation.

27. Leak testing of ductwork (ductwork downstream of terminal boxes, returns, exhaust, and outside air duct will visually inspected) is required. Maximum allowable leakage is 5 percent of design flow. Air and Water Balancing Contractor will conduct the leak testing of the ductwork for the University's acceptance. Test method to be in accordance with SMACNA "HVAC Duct Construction Standards".
28. Multiple blade air flow control dampers shall be opposed blade, low leakage type with sealed ball bearings for damper blade shafts.
29. Multiple blade air flow control dampers shall be opposed blade, low leakage type with sealed ball bearings for damper blade shafts. All damper actuators to be mounted outside ducts.
30. Weather-proof lights with externally mounted switches shall be installed between coil sections and in blower section.
31. All air handler motors shall have variable speed drives.
32. Fan coil units located in exit stairwells shall be interlocked with additional fire alarm devices that discontinue FCU operation when the fire alarm system is activated. The FCU may only serve the area in which it is located.

D3045 CENTRIFUGAL PUMPS

1. Centrifugal pumps shall be horizontal split case type.

D3060 BUILDING TEMPERATURE CONTROL SYSTEM

1. The selection of the building controls will be by UH Utility Services (EMECS) department. The temperature control system for the new building projects or large renovation projects shall be fully open native Bacnet system. BACnet building automation system specifications can be found at: http://www.uh.edu/plantops/departments/fpc/master-specs/23%2006%2006UH%20BACnet_Spec11.pdf.
 - b. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Depict each mechanical system and building floor plan by a point-and-click graphics.
 - c. An Uninterrupted Power Supply (UPS) is required on all control panels, not just primary.
 - d. An open license JACE 600 or higher shall be installed on separate IP address and tied into the buildings' BAS system.
 - e. If individual software seat licenses or keys are required provide a minimum of 10 additional licenses to accommodate multiple owner operators.
 - f. The system shall directly control HVAC equipment as specified in Sequences of Operation. Each zone controller shall provide occupied and unoccupied modes of operation by individual zone.
 - g. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints.
 - h. System shall use the BACnet protocol for communication. Schedules, setpoints, trends, and alarms specified in Sequences of Operation shall be BACnet objects.
 - i. All network addresses, device addresses, and point names must be visible and controllable (by UH Utility Service EMECS group) from the provided programming tool.
 - j. The Bacnet "stack" must reside on each Bacnet controller (physically on the device and not on the Master sharing proprietary devices).
 - k. All devices must bear the BTL certification stamp and with details such as UH Building #, Equipment controlled, location etc.)

- I. Coordinate with UH Plant Operations Utility Services (EMECS) group for the type of control system to be specified for small renovation projects in the existing buildings with Honeywell or JCI control systems.
2. Pneumatic actuators and controls are not to be used unless prior approval has been obtained from UH Utility Services Department.
3. Fire detection and alarm functions and security system functions are not to be part of the EMECS. Separate fire and security systems are required.
4. Installation:
 - a. Provide a securable 16" deep x 3' wide x 8' tall securable closet in every new building in the Main Mechanical Room where the Master BAS Controller/Phoenix Server will be housed and the air conditioning, IP ports, and electrical will be provided.
 - b. Control valves must not be installed upside down
 - c. All exposed control wiring in mechanical rooms or inaccessible locations to be in EMT conduit.
 - d. Do not install control panels under water lines or next to water lines and equipment that could damage control panel in event of water leak. Do not make conduit penetrations in top of panel.
 - e. Each control panel must have at least 20 percent spare capacity. Spare capacity can be achieved with the addition of I/O modules at a later date. Conduit shall have 10 percent spare capacity if conduit length is over 100 feet.
 - f. All low-voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5 ft centers, secured with plastic tie-wraps, smoke rated for plenum installation and not dependant upon the ceiling grid for support. Control wiring is to be run at right angles to or in parallel with axis of rooms and not diagonally across ceilings, etc.
 - g. Control wiring shall not be installed in the same conduit with power wiring.
 - h. Control wiring for service up to and including 24 volts shall be rated for at least 300 volts.
 - i. All temperature sensors shall be calibrated by controls contractor at startup and calibration data sheets showing offsets submitted to Utility Services (EMECS).
 - j. All air handler chilled water control valves shall be two-way valves. All wiring to be green with white stripe and with text saying Bacnet EMECS wiring.
 - k. Chilled water and hot water valve control to be separate controller outputs; tandem control from a single control output is not to be used.
 - l. Actuated valves on the building chilled water supply and return shall be provided to allow for emergency, maintenance, or replacement isolation of

the building piping system from the distribution loop. The valves shall be located just inside the building in an easily accessible location. Where specified for isolation, actuated valves shall be provided on the tertiary chilled water supply and return piping.

- m. New control panel locations and reuse of existing locations for new installations must be approved by Utility Services (EMECS).
 - n. All exposed old and unused EMECS components, wiring and conduit to be removed by controls contractor.
 - o. Locations of temperature and humidity sensors must be approved.
 - p. Single spaces served by more than one VAV, fan coil unit or air handler are to be controlled by input from a single temperature sensor with single set point. Exceptions for multipurpose spaces must be approved by Utility Services (EMECS).
 - q. Control of outside air dampers shall be from dedicated analog or digital outputs as required by the sequence of operation.
 - r. All single zone air handling units shall have a discharge air temperature sensor mounted in the supply air at discharge from the chilled water and hot water coils.
 - s. Steam flow to hot water converters shall be controlled by one third capacity valve and two thirds capacity valve. Each valve shall have a separate control loop.
 - t. All field wiring shall be labeled both in control panels and at device. Use text descriptive labels, not just numeric identification; for example AHU1CLVLV.
 - u. Terminal strip required for all connections in control panels.
5. Service Requirements – General
- a. All variable speed motor drives must restart automatically after loss of power.
 - b. Air handler chilled water and hot water valves to shut off automatically when air handler is stopped.
 - c. Air handler chilled water valves are to fail in the as-is position.
 - d. Simultaneous air cooling and heating is not permitted, except reheat for humidity control, and one valve must be closed before the other can open. Both valves will be controlled by discharge air temperature.
 - e. Status indication for valves and other control elements to be 0 for closed and 100 for open.
 - f. Graphics must be schematically correct and represent the actual physical configuration of air handlers, pump systems, floor plans, etc. Room locations for all equipment, including sensors, must be shown and the room numbers for spaces served by electric duct heaters, VAV boxes, etc. must be shown on air distribution mechanical plans.
 - g. Automatic controlled valves shall be furnished by controls contractor unless otherwise indicated in the bid documents. Automatically controlled dampers, except dampers integral to the air handling units, shall be furnished by Controls contractor .
 - h. VAV box dampers, fan relays, electric duct heater relays, and 24 volt control power supply transformers shall be provided by the terminal unit manufacturer.

Building controls contractor will furnish the Application Specific Control Unit (ASCU), temperature sensor, and damper actuator. The ASCU will be shipped to the VAV terminal manufacturer to be mounted on the unit. Controls contractor will provide all necessary labor and miscellaneous cost associated with set up and testing of the controllers prior to shipment. A typical controller shall be tested for inclusion of all necessary features and control system compatibility. UH Utility Services (EMECS) may elect to have all units tested and witnessed by assigned staff.

- i. All 120 volt power to pump room, central fan system, and terminal unit DDC controllers shall be by the Division 16 contractor. All 120 volt and 24 volt power to combination fire/smoke dampers and smoke dampers shall be by the Division 16 contractor.
- j. Controls contractor will submit for approval complete brochures and schematics for entire control system, including performance curves showing leakage rate for dampers, and data indicating trim, pressure ratings and close off pressure for valves. Controls contractor will submit for approval schematic diagram drawing which show all temperature control, equipment interlocks, and all connection information required for properly controlling the mechanical equipment. Controls contractor will provide for approval a complete points schedule and schedule showing each item of mechanical equipment and the start-stop arrangement of each. Each schematic shall have an accompanying verbal explanation of the control functions.
- k. Controls contractor will provide as built drawings on AutoCAD edition specified by FP&C of all control installation drawings and submittals. Drawings shall show panel locations, 24 volt DC sources, zone controller locations, communication wire path, and electric reheat panel locations.
- l. EMECS readout for air handler discharge air temperature (each zone) is required for all air handlers, fan coil units, and double duct mixing boxes.
- m. All controllers have portable operator's terminal jack for programming and troubleshooting.
- n. Conduit and wire between the fire alarm systems and the Fire/Smoke Dampers and Smoke Dampers to isolate smoke zone in the event of a fire shall be by the Division 16 contractor. Conduit and wire between the fire system control relay and HVAC fan motor starters to de-energize the fan in the event of a fire shall be by the Division 16 contractor.
- o. Terminal strip required for all connections in control panels. Dampers shall have manual and automatic control from 0-100% from building automation control interface.
- p. Electric duct heaters with more than one element or strip shall be staged to control operation as heating load varies.

6. Standard Control Sequence - VAV Air Handling Unit Type A

- a. The supply of air fan shall be provided with a hand-off-auto (HOA) switch at the motor variable speed drive. When the HOA switch is in the auto position, the supply fan shall be started and stopped through the EMECS. When the HOA is in

the hand position, the supply air fan shall be manually started and stopped. The air flow status of the fan shall be indicated at the EMECS through a differential pressure air flow switch.

7. Standard Control Sequence - Multizone Air Handling Unit Type
 - a. The supply air fan shall be provided with an HOA switch at the motor drive or starter. When the HOA switch is in the auto position, the supply air fan shall be started and stopped through the EMECS. When the HOA switch is in the hand position, the supply air fan shall be manually started. Status of the supply air fan shall be indicated at the EMECS through a differential pressure air flow switch.
 - b. The outside air damper shall open fully whenever the supply air fan is energized or a start signal is issued from the EMECS. It shall be fully closed when the supply air fan is de-energized.
 - c. A temperature sensor (THIS SENSOR MUST BE ON ALL AIR HANDLERS REGARDLESS OF CW VALVE CONTROL INPUT), sensing the air leaving the chilled water coil, shall provide an input to the DDC panel which shall, through a proportional plus integral DDC control algorithm, output a signal to modulate the normally open chilled water control valve to maintain 55 degree F discharge air temperature. The control valve shall close when the air handling unit is stopped.
 - d. Space temperature shall be input into the DDC panel for each zone. The DDC panel shall output a signal to modulate the zone damper and reheat valve (or electric duct heater) in sequence to maintain space temperature set point. The control shall incorporate adequate dead band to prevent simultaneous heating and cooling of air except for humidity control. The heating system will shut off when the air handler is stopped.
 - e. Each zone shall have separate discharge temperature sensors and independent control for each zone damper and heating valve or electric heat.
 - f. Constant speed air handlers must be provided with variable speed driver for soft start and air flow adjustment.

8. Standard Control Sequence - Preheat Coil
 - a. A wall mounted temperature sensor shall input to the DDC panel which will output a signal to modulate the cooling and hot water coil valve in sequence (no over lap of opening) to maintain space temperature. Status of the supply fan shall be indicated at the EMECS through a differential air flow switch. Air handler discharge air temperature shall be indicated at the EMECS through a discharge temperature sensor. Unit shall operate on 100 percent return air unless specifically noted on design drawings.

9. Standard Control Sequence-Preheat Coil
 - a. A temperature sensor sensing the air leaving the preheat coil shall provide an input to the DDC panel which shall, through a DDC control algorithm, output a signal to modulate the preheat coil hot water control valve (or electric heating

coil) to maintain a minimum leaving temperature of 55 deg F. If the air temperature leaving the preheat coil falls below 35 deg F, a manual reset low temperature thermostat shall full open the chilled and hot water valves, de-energize the supply fan, and produce an EMECS alarm.

10. Standard Control Sequence-Single Duct VAV Terminal Units
 - a. The single duct VAV terminal units shall consist of a volume damper, an air flow pickup, a microcontroller, damper actuator, and a space temperature sensor.
 - b. The microcontroller and damper actuator shall be provided by Controls contractor to the terminal unit manufacturer for factory installation and calibration. Controls contractor shall furnish and install communication bus to the microcontroller and low voltage wiring between the space temperature sensor and the microcontroller.
 - c. The primary air volume damper and the reheat valve (or electric duct heat stages) shall be modulated in sequence by the DDC microcontroller in order to maintain the space temperature as sensed by the electronic temperature sensor. The microcontroller shall, through its air flow pickup in the primary air supply duct, provide for pressure independent volume control.

11. Standard Control Sequence – Fan Powered Induction Boxes
 - a. The fan powered induction box shall consist of a fan, electric duct heater, if scheduled, a volume damper actuator, and a space temperature sensor.
 - b. The microcontroller and damper actuator shall be provided by controls manufacturer to the terminal unit manufacturer for factory installation and calibration. Controls manufacturer shall furnish and install communications bus to the microcontroller and low voltage wiring between the space temperature sensor and the microcontroller.
 - c. On a call for full cooling, a wall mounted temperature sensor shall modulate the cold air valve fully open. The pressure independent microprocessor control network shall cause the supply air quantity to not exceed the scheduled amount and automatically maintain desired air flow with up stream fluctuations of up to two inches water gauge.
 - d. On a call for less cooling, as sensed by the room temperature sensor, the cold air valve shall modulate from fully open to the scheduled minimum air quantity.
 - e. On a call for heat, with the supply air at scheduled minimum quantity, the electric duct heater stages shall schedule as needed to maintain space temperature.
 - f. The VAV unit supply fan shall be interlocked through software to run anytime the air handling unit fan is on and automatically stop when the air handling unit fan is off.

12. Warranty period will commence upon completion of all point acceptance testing for EMECS work performance and acceptance by UH Utility Services Department.

13. All PID control loops shall be tuned by controls manufacturer to ensure stable (no hunting). Tuning to be verified by Utility Services (EMECS).

14. Only alarm points specified by Utility Services (EMECS) shall be displayed to operators terminals.
15. Control System Element Specifications:

Water Valve Actuators

Averaging temperature sensor - All AHUs shall have averaging temperature sensors with a probe length of 12 feet minimum or one linear foot per square foot of duct cross-sectional area, whichever is greater.

Single point duct mounted temperature sensor shall be stainless steel probe of 12 inch length with duct mounted moisture/waterproof housing with conduit fitting.

Temperature sensor thermowell shall be rigid stainless steel probe of length which is, at minimum, 20% of pipe width with stainless steel thermowell. Provide with thermal grease to aid temperature sensing.

Freezestat shall be a minimum 20 feet vapor tension element which shall serpentine the inlet face on all coils or one linear foot per square foot of coil surface area.

Duct mounted static pressure sensor shall have an input range of 0 to 500 Pa (2.0 inches w. g.) and be easily accessible, integral non-interacting zero and span adjustment.

Space static pressure sensor shall have an input range of -0.1 to +0.1 inches w.g., and be easily accessible, integral non-interacting zero and span adjustment.

Duct mounted air flowrate sensor shall be multipoint flow cross or grid measuring device with bulkhead fittings to allow sensor tubing to be connected or removed without removing ductwork. Sensing grid shall be constructed of 304 stainless steel.

Fan inlet air flowrate sensor shall be multipoint flow cross or grid measuring device mounted at the inlet of the fan. Bulkhead fittings to allow sensor tubing to be connected or removed without removing the device from the fan shall be provided.

Differential pressure for liquid flow shall be a microprocessor based transmitter which measures differential pressures and transmits an output signal proportional to the measured variable. Manufacture: Rosemount 1151 Smart Pressure Transmitter with equalizing manifold.

D3070 AIR AND WATER BALANCING

1. FP&C will provide air and water balancing services under separate contractor.
2. Contract will be required to support access to equipment for air and water balancing contractor. For example, the contractor may need to provide ladders or a lift for equipment access.

D40 FIRE PROTECTION

D4000 GENERAL (see also Section 12.0d-- ADDENDUM D: Alarm and Special Hazard Protection Specifications)

1. The University of Houston Fire marshal's office is the Authority Having Jurisdiction ("AHJ") for the University of Houston System.
2. All University of Houston fire alarm devices, components and controls will be SimplexGrinnell. No other manufacturers' fire alarm devices, components or controls are allowed without written approval from the Associate Vice Chancellor/Vice President of Plant Operations and the University of Houston Fire Marshal's office.
3. All fire suppression controls must be compatible (interface and full communication capable) with SimplexGrinnell's controls and network system.
4. All fire and life safety system plans must be reviewed, approved, and stamped by the University of Houston Fire Marshal's Office prior to installation.
5. Acceptance tests must be conducted for all fire and life safety systems prior to occupancy. The University of Houston Fire Marshal's Office must conduct and/or witness all such testing

D4010 SPRINKLERS

1. All University of Houston buildings will be sprinklered.
2. The design consultant shall include in the bid documents the fire protection sprinkler system – sprinkler head and main header location plans, riser locations and diagram. Risers shall include sprinkler header take-offs with fire alarm points located.
3. Drawings shall be laid out to allow for the addition, at the completion of construction, all as-built header and branch piping to each sprinkler head.
4. The fire protection sprinkler system and standpipe system shall be designed by a registered professional engineer or an organization which possesses a valid certificate of registration as issued by the state fire marshal and has at least one (1) person engaged in or working on the actual plans, who is licensed to perform the work authorized by his certificate.
5. The fire protection systems shall be designed in accordance with the requirements of National Fire Codes and these guidelines except that electrical rooms housing switch gear, transformers, and emergency generators will not be sprinklered nor have any pipes routed through their space. All materials shall be approved by

Underwriters Laboratories and/or Factory Mutual Laboratories. Compliance with Article 5.43-1 and 5.43-3, Texas Insurance Code is required.

6. Sprinkler piping shall be Schedule 40 A.S.T.M A53 steel pipe. No flexible sprinkler head drops will be allowed. Only hard-piped offset and drops will be permitted.
7. Sprinkler piping on each floor shall have isolation valves with tamper switches at riser connections.
8. Smoke detectors are also required in buildings with sprinkler systems.
9. At connections to fire service main, fire protection systems shall include a post indicator valve installed outside the building in accordance with NFPA 13 and a building-interior sprinkler control valve with indicator in the sprinkler riser room.

D4030 FIRE PROTECTION SPECIALTIES

1. The number, size and type of portable fire extinguishers shall be in accordance with the requirement of NFPA-10 and as determined by FP&C. Compliance with Article 5.43-1, Texas Insurance Code is required.
2. Fire fighting equipment, such as hoses and extinguishers, shall be approved by the UH Department of Public Safety Fire Marshal office.
3. University of Houston fire protection consultant will review the design consultant's plans and make recommendations to incorporate in the bidding documents.

D50 ELECTRICAL

D5000 GENERAL

1. Electrical and telecommunications rooms will stack vertically through the building.
2. Provide 2 hour rated walls for all electrical and telecommunications rooms.
3. Electrical and telecommunications rooms will be open above the ceiling and have a minimum of three open walls for distribution.
4. Electrical wall outlets which include a USB port for charging electronic devices may be considered for student lounges, classrooms, informal learning spaces, and similar spaces.
5. In all new facilities/major electrical renovations, a confirming Short-Circuit study shall be performed in order that all new circuit breakers, panelboards, fuses and other protective devices are properly rated for the maximum imposed system fault

current. A Protective Device Coordination study shall also be performed to provide device settings for adjustable circuit breaker trip devices.

6. Projects of lesser scope which add to or change the existing balance of the existing electrical infrastructure shall also be considered for these two studies. Confirm with Plant Operations FM Utility Group.
7. A 208 Volt single phase 2 pole 30 amp twist lock receptacle shall be added to the roof for the proper operation of a swing stage

D5010 CAMPUS ELECTRICAL SERVICE AND DISTRIBUTION

1. Electrical service for the campus is furnished by Centerpoint to the University of Houston Cougar Substation at 138 KV. From Cougar Substation, 12.47 KV power is supplied by three feeders to the Central Plant and then to campus buildings through the utility tunnel from the switchgear in the Central Plant. Each of the main campus buildings is served by two 12.47 KV feeders with an automatic transfer switch to supply electrical power to a building in case there is a loss of power from the primary feeder. Each building has a transformer to reduce the 12.47 KV distribution voltage to the required building service voltage. New building service voltage shall be 277/480 volts, 3 phase, 4-wire wye.
3. Dry type transformers shall be used for building electrical service to provide 480 volt to 120/208 volt, 3-phase, 4-wire, wye distribution.
4. The building 12.47 KV transfer switches shall be 3-position (preferred feeder, off, standby feeder) **utilizing load side vacuum interrupters** which will be coordinated with system vacuum breakers. **Mechanical interlocking is required to prevent paralleling of feeders.** Transfer switches are to be SF6 type.
5. Building distribution switchgear shall have a Square D Class CM4000 power logic circuit monitor(s) with AO420 attachment or (alternate approved by FP&C/FM). The following parts are necessary: CMDVF Vacuum Fluorescent Display, JOX I/O extender module, CAB12 Serial cable, Current Transformers either clamp-on or molded, fuse holders and fuses on voltage circuit, shorting block for CT circuit. The power monitor shall have a digital display capable of monitoring all primary power parameters including total harmonic distortion on voltage and amperage.
6. Confirm smart electric metering need with FP&C Project Manager: Electrical energy savings have the greatest benefit to the campus utility budget, therefore electric meters will be the top priority for project inclusion, followed by water, chilled water, and steam meters. Auxiliary buildings will be the highest priority for meter location, followed by science and research buildings, followed by E&G buildings 40,000 SF and larger. Smart electric bases of design are:

- i) E-Mon Class 5000 Smart Meter w/Dual Protocol Communications featuring 4-line display (kWH, KWH/Demand with peak time and date, power factor per Phase, kW real-time load, and amps and volts per phase). On Board Set Up Options shall include IP Address, meter date/time ID codes for E27 and BACnet.
 - ii) E-Mon Green Class Meter with CO₂ and Carbon Footprint Data featuring direct-read two-line LCD display showing kWH, current load, peak Demand in kW and peak date and time; to-date energy cost based on user-entered cost per kWH and projected hourly cost based on metered load; and display of total carbon (CO₂) emissions in pounds (lbs.) and hourly emissions based on metered load.
7. Electrical smart-meters shall be located in the building electrical rooms.
8. Underground 480V (and greater) KV electrical power cables to be in 4 inch PVC conduit encased in red concrete. The top of the concrete duct bank shall be a minimum of 36 inches below grade. A number 4 rebar shall be installed in each corner of the duct bank. PVC conduits shall be supported in duct bank using PVC spacers providing a minimum of 3 inch separation between conduits.
9. Power cable for 12.47 KV electrical power distribution in utility tunnel must be in 4 inch rigid aluminum conduit. Conduit shall be supported vertically with unistrut brackets that extend from the floor to the ceiling or the tunnel. Brackets shall be anchored to the structure at both ends using suitable anchors. Conduits shall not be supported from the wall of the utility tunnel.
10. All 12.47 KV conduit fittings shall be threaded. Where conduit unions are necessary, provide Appleton type EC or Thomas and Betts "Erikson Coupling".
11. Use rigid galvanized steel elbows or rigid aluminum elbows in utility tunnel and building conduit runs. The minimum bending radius of conduit elbows shall be 36 inches.
12. Cable for 12.47 KV distributions shall be #2/0 copper 15 KV EPR Okonite No. 115-23-3117 or UH approved alternate with a 220 mil 133 percent insulation level and tape shield. The ground cable shall be #2 stranded soft drawn bare copper wire.
13. Prior to completion of the work and before final review and acceptance of all 12.47 KV feeder construction work, all cable shall have high potential proof tests performed and test results accepted by FP&C. Utility Services shall be present and witness the testing.
14. The 12.47 KV service at each new building must be tested to insure proper phasing for rotation and to insure the phase sequence for each feeder is the same for the building.

15. All below grade building or utility tunnel conduit wall penetrations must use Thunderline Corporation "Link Seals" to make penetrations leak proof.
16. Manufacturer's specified minimum bend radius for cable shall not be exceeded.
17. When cable is in free air, it shall be anchored at 3 foot intervals with Unistrut Force-A-Clamp insulators P1787A through P1795B or equivalent.

D5015 BUILDING ELECTRICAL EQUIPMENT AND ELECTRICAL DISTRIBUTION

1. Use heavy chrome-plated or nickel-plated escutcheons for conduit passing through walls and ceilings of finished areas. Use B&C Number 10 or alternate approved by FP&C/FM.
2. Whenever access is required through wall or ceilings to concealed junction boxes or other concealed electrical equipment, a hinged access door and frame is required to be installed with door opening location and opening size as required for inspection and maintenance. Access door to be equipped with cam locks.
3. Motors:
 - a. Premium or super efficiency motors with cast iron frame are to be specified (Gould E-Plus, General Electric "Energy Saver", Reliance XE, Century, Balor Super E or UH approved alternate).
 - b. Motors are to be specified with Class F insulation and Class B temperature rating.
4. All wiring terminations shall be labeled in the pull box, distribution panels, and switchgear. All outlet devices connected to emergency power shall be identified by labeling stating that it is an emergency device, or the device itself shall be colored red. A red painted cover is an acceptable substitute for red coloring provided by the device manufacturer.
5. All #6 AWG and larger conductors shall be connected with high conductivity, wrought copper, color-keyed compression connectors. Crimping tools, dies, and connectors to be by same manufacturer, and crimping shall be done by electricians certified for the crimping tools used.
6. Bolted Bus Bars:
 - a. All electrical bus must be copper.
 - b. Bus bars shall be 98 percent conductivity, round edge copper with through bolted connections.
 - c. Bolted bus joints shall be ring silver plated and shall contain a minimum of two bolts per joint. Utilize U.S. manufactured, capacity identified, silicone bronze bolts, nuts, flat washers, and lock washers. The torque wrench settings and the required bolt capacity for splice plate connections, etc. shall be listed on the

Shop Drawing for the bus assembly. All torque values to be verified and approved in writing by project licensed electrical engineer. Bolted connections must be accessible for inspection and maintenance.

7. Wiring:
 - a. All wiring must be copper.
 - b. All electrical power wiring must be installed in conduit (EMT, or rigid galvanized steel conduit).
 - c. Use mogul LB conduit fittings.
 - d. All wire insulation to be THHN or THWN.
 - e. All feeders and branch circuits shall be #12 AWG or larger.
 - f. All wire larger than #10 AWG shall be stranded.
 - g. Flexible metal conduit is permitted at motor, fixture, and other equipment only.
 - h. The contractor shall follow the manufacturer's directions for delivery, storage and handling of equipment and materials.
 - i. Equipment, electrical cable, and material shall be tightly covered and protected against dirt, water, chemical, physical or weather damage and theft.

D5020 LIGHTING

1. Building interior light shall primarily be T-5 or T-8 Florescent lamps with electronic ballasts.
2. LED fixtures shall be considered for elevator lobby, stairwell, high ceiling, and other difficult to access ceiling areas. Lighting designer shall confirm adequacy of light distribution in evaluating suitability of LED usage in these applications. LED lighting will otherwise be considered on a case-by-case basis.
3. U-tube lamps shall not be used.
4. Classroom and office lamp color temperature shall be between 3,000 and 3,500 degrees Kelvin.
5. LimeLite Technologies', Inc. proprietary Light Emitting Capacitor (LEC) DirectVu™ lamp may be used for exit lighting.

D5030 FIRE DETECTION AND ALARM SYSTEM

1. All systems must be SimplexGrinnel voice "capable," and communications compatible with the campus fire alarm network.
2. The design consultant will meet with the University's designated fire alarm consultants to receive their recommended design factors. The design consultant will incorporate required design factors into the bidding documents. The fire alarm consultant will prepare the required drawings that will be inserted into the bidding documents.
3. The fire detection and alarm system shall be designed in accordance with requirements of pertinent sections of the National Fire Codes by a firm registered in the State of Texas and whose employees have a valid fire alarm planning

superintendent's license or fire alarm technician's license issued by the state fire marshal. All material shall be approved by Factory Mutual Laboratories and Listed by Underwriters Laboratories. Compliance with article 5.32-2, Texas Insurance Code is required.

4. The Control Center shall be located in a secured area inside of a building.
5. Four (4) fiber optic cables are required for each building fire alarm system service connection tie-in to the campus fire alarm network.
6. Smoke detectors are also required in buildings with sprinkler systems.
7. Four percent (4%) spare sprinkler parts (or quantity per NFPA-13, whichever is greater) are required.
8. SimplexGrinnel shall provide training for sprinkler system and fire alarm system operation.
9. A mass notification system such as Alertus Beacons is required in certain public spaces. Consultant shall coordinate with the UH Department of Public Safety and FP&C for specific requirements.

D5035 TELECOMMUNICATIONS SYSTEMS AND FACILITIES DESIGN

1. Up to date Telecommunication system and facilities requirements / network cabling standards and recommendations can be found at: <http://www.uh.edu/infotech/services/computing/networks/telecom-infrastructure-standards/index.php>
Or by typing "telecommunication infrastructure standards" into the uh.edu search engine.
2. Telecommunication facilities are typically dedicated spaces which are not shared with other building services. Entrance Facilities, Equipment Rooms, Telecommunication Equipment, and Telecommunication Rooms may not be accessed through mechanical or electrical rooms.

D5040 ACCESS CONTROL MANAGEMENT

1. The Access Control System shall be the BASIS Access Control Management System so as to interface into the existing BASIS Access/Cougar One Card System. System shall be provided by Stanley Convergent Security Solutions, Inc., Contact: Mr. Terry Clymer, Ph.: 832-289-4538, Fax 713-861-7808, Terry.Clymer@sbdinc.com. Full system specifications may also be obtained from this contact or from the UH Access Control Shop.

2. Access Control Contractor shall provide and install all low voltage plenum cabling to access control devices and electrified door hardware, and make all low voltage connections. All low voltage cabling must meet or exceed UH standard for low voltage cabling installation.
3. Access Control Contractor shall provide door lock power supplies if not provided with door hardware for all devices and supporting devices. Power supply for latch retraction must be the same manufacturer as the exit devices.
4. Access Control Contractor shall provide specified BASIS client software (if specified), and associated training.
5. The UH Department of Public Safety/ Electronic Access Control Manager shall indicate which of the following typical locations: doors, frames and door hardware, elevators, automatic doors, and building entrances shall be equipped with the access control management system. See also B2031 Exterior Door Hardware and C1025 Interior Door Hardware.
6. Access control equipment may include magnetic stripe and proximity card readers, intelligent system controllers, system enclosures, input panels, output panels, interface relays, power distribution modules, door contacts, egress motion detectors, exit buttons, RTE hardware at exit-only doors, door prop horns, key switches, system power supplies, fused relay outputs, back up batteries, and power distribution modules for fail-safe locks only (to be tied into the building fire alarm system).
7. Submittals for the access control management shall be integrated with submittals for the components into which the access control equipment shall be incorporated (e.g. frames, elevators) to ensure the design intent of the system/assembly is completely understood and can be reviewed together. All access control installation doors require adequate submittals be submitted prior to commissioning of door.
8. Distributor shall program all system and door set up information. All programming standards shall meet Programming Standards created and approved on 09/10/2016. Owner shall program all cardholders and access levels and provide final door labeling information for programming.
9. Eye readers may be used in-conjunction with Mag-swipe readers with special approval from Assistant VC/VP, Public Safety and Security including the UH Access Control Shop and Electronic Access Control Manager.
10. All Access Control Panels will be tied into buildings Life Safety (back-up) Generator when applicable.

D5090 EMERGENCY GENERATORS

1. Emergency generators must meet the conditions of the Texas Commission on Environmental Quality (TCEQ) by rule or be individually permitted. City of Houston requirements that all tanks installed in its jurisdiction shall be UL 2085 listed tanks which are fire rated and double walled
2. Best practice is to use natural gas fueled emergency generators. If fuels other than natural gas are used for emergency generators, tanks must be double-walled; tanks larger than 1,100 gallons require registration to TCEQ. Contact Environmental Health & Safety for assistance.
3. All new generators installed on the UH campus must have engines that comply with current provisions of Part 40 Code of Federal Regulations (CFR) 89.102 for Tier 1 emission limits.
4. All emergency generators must be equipped with a non-reset run meter. Testing of generators is prohibited from 6:00 am to 12:00 pm in Harris County, unless they are operating under emergency conditions.

ELEMENT E

E10 EQUIPMENT

E1090 SPECIAL EQUIPMENT

1. Areas in which commercial kitchen equipment will be located shall have adequate space between adjacent equipment and equipment and the wall to allow for maintenance and cleaning. Whenever possible, equipment shall be on locking casters to permit maintenance or cleaning). Equipment on wheels shall be anchored.

E20 FURNISHINGS (NOT USED)

ELEMENT F

F10 SPECIAL CONSTRUCTION

F1010 SPECIAL CONSTRUCTION-DUMPSTERS

1. The site design for new facilities shall include an enclosed dumpster area. Dumpster locations shall provide convenient and access to vehicles emptying the dumpster, shall be in less visible areas of the site, and shall be screenable by planting, fences and/or walls. Chain-link fencing shall not be used.

2. Dumpsters shall be located on pads. Dumpster pads shall feature positive drainage to prevent standing water, and areas surrounding dumpster pad shall feature positive drainage away from the dumpster pad.
3. Sanitation trucks shall be able to approach the dumpster enclosure in a straightforward direction, align with the dumpster, reverse away (T-turnaround or similar) from the dumpster enclosure and exit the site. It is preferable that trucks do not have to back out of the site or make a 360 degree turn to exit the site.

ELEMENT G

BUILDING SITEWORK

G10 SITE PREPARATION

G1000 GENERAL [NOT USED]

G1001 COMPLIANCE WITH THE TEXAS UNDERGROUND UTILITY LOCATION PROGRAM

1. Texas law requires all excavators using mechanical tools to provide advance notice prior to digging, excluding weekends and holidays. Proper notification requires an excavator engaged on University of Houston projects to contact UH Utility Services and Lone Star Notification Center of a planned excavation no more than fourteen days and no less than forty-eight hours before the excavation (s) is/are expected to commence.
2. Excavators engaged on campus projects shall enter the project information on two faxable forms, which may be obtained through the FP&C Project Manager assigned to the project or from Utility Services (713-743-5791).

G1002 TOPOGRAPHIC ELEVATIONS

1. All elevations shown on site plans, floor plans (architectural, structural, HVAC and electrical), building elevations, wall sections, details, etc. shall be actual elevation above mean sea level (USC & GS) as provided by the survey data.

G1005 TRASH REMOVAL

1. Trash receptacle locations should be at grade level and should be placed so that the receptacle can be loaded from top as well as side. The receptacle location should be screened from public view. Where the receptacle location is integral with the building it should be screened in a manner consistent with the general building design. Verify method of disposal (front loading or rear loading trucks). at each building with UH and FP&C/FM

2. Trash receptacle area should be adequately lighted for night use.
3. At receptacle locations, provide a reinforced concrete pad of sufficient size and strength to accommodate the receptacle and truck.
4. Where the receptacle location is integral with the building all associated stoops, porches, docks, and steps, exterior and interior should have built-in abrasive surfaces. Slope exterior porches and treads to drain water $\frac{1}{4}$ " per foot. Exposed concrete finish work shall be accomplished in two pours; the first being structural, and the second being a two inch minimum finish topping poured near completion of project.

G1010 SITE CLEARING

G1011 EXISTING TREE PROTECTION

Mature and well developed trees should be preserved in the site design. Such trees should be well pruned prior to construction and should be protected with positive devices at the TPZ for the duration of the project. TPZ is 1.50 feet away in radial distance from the trunk for every inch in stem diameter. No materials or equipment are to be stored beside or beneath the trees. Trees to be preserved will be approved by FP&C/FM.

G1020 SITE DEMOLITION AND RELOCATIONS

G1021 EXISTING TREE RELOCATION

Many trees on the UH campus are of an age that will allow for relocation. Such trees will be relocated from the site, if necessary, to locations elsewhere on the campus as determined by FP&C/FM. Some existing trees on the campus should be relocated for the maximum health of earlier plantings. These trees should be incorporated into the site design if possible. FP&C/FM will designate such trees. Existing trees should be relocated only in late fall and winter; they should be watered and cared for a year.

Some trees on the campus have been planted in honor of or in memory of someone. If these trees must be relocated or removed, the dedication device must be relocated with the tree or reinstalled with the replacement tree. The UH will coordinate this effort with the donor if known.

G1022 EXISTING TREE REMOVAL

Existing trees that must be removed and are not to be relocated must be replaced on the site or elsewhere on campus as determined by FP&C/FM. The replacement trees shall be equal in total trunk diameter to the total trunk diameter of the trees to be removed, as measured four feet from the ground level at the trunk. Replacement trees are to be no smaller in individual diameter than 3 1/2 inches. Unless otherwise directed by FP&C/FM, the replacement trees will be live oaks.

G1030 SITE EARTHWORK Refer to SECTION 7.0 SUSTAINABLE DESIGN GUIDELINES.

G20 SITE IMPROVEMENTS

G2000 GENERAL [NOT USED]

G2010 ROADWAYS

Streets and related subterranean storm drainage are to be designed and constructed in accordance with City of Houston Standards.

G2020 PARKING LOTS Refer to SECTION 9.0 PARKING STANDARDS AND GUIDELINES and Master Construction Specifications Division 32.

G2030 PEDESTRIAN PAVING Refer to SECTION 6.0 LANDSCAPE DESIGN GUIDELINES, SECTION 9.0 PARKING STANDARDS AND GUIDELINES, and Master Construction Specifications Division 32.

G2040 SITE IDENTIFICATION

1. The text for the building dedicatory plaque will be provided by the University. Refer to SECTION 10.0 WAYFINDING STANDARDS AND GUIDELINES.
2. Free standing exterior building identification to be provided by UH. Refer to SECTION 10.0 WAYFINDING STANDARDS AND GUIDELINES.

G2050 LANDSCAPING Refer to SECTION 5.0 LANDSCAPE DESIGN GUIDELINES and Master Construction Specifications Division 32.

G2052 EROSION CONTROL MEASURES

Industrial activity including clearing, grading, and excavation activities of construction sites of one or more acres are required to develop and implement a Storm Water Pollution Prevention Plan (SWP3) and file a notice of intent (NOI). Sites smaller than 1 acre are required to employ best practices with regard to site disturbance, runoff velocity, retained sediment, functioning of storm drainage facilities, etc. For a more complete description of principles of storm water management for construction activities at the University of Houston, refer to:

www.uh.edu/plantops/emanual/forms/ehrm/e_handbook_aid_compliance_storm_water_management.doc -

G403006 SURVEILLANCE CAMERAS

1. General:
 - a. Refer to Master Specification Section 28 23 00 for current camera specifications.
 - b. Refer to <http://www.uh.edu/infotech/services/computing/networks/telecom-infra-standards/index.php>, for use requirements.

2. Location and Coverage:
 - a. Cameras at entrances and exits to the building shall show the faces of those exiting the building in high detail resolution. Cameras in public hallways shall show an individual's movement within the building.
 - b. Classrooms: Generally there will be no cameras in classrooms.
 - c. Research space: Cameras shall show persons exiting the research facility in high detail resolution. Cameras in the hallways shall show the movement of persons within the research facility. Cameras shall only be employed within the research spaces themselves only when there is a need to monitor the health and safety of the researchers.
 - d. Administrative space: Cameras shall be installed in in the hallways and shall show movement of persons in the building.
 - e. Residential spaces: Cameras shall be located to show activity in the common areas, including lounges, laundry, computer labs, etc. No cameras shall be located within in the bedroom units.
 - f. Point-of-Sale and cashier areas: Cameras shall be located to show patrons' faces in high detail resolution at the Point-of-Sale.
 - g. Surface parking lots and campus roadways: Cameras shall be located to show the description of the vehicles (color and make during daylight hours). Cameras shall show license plates of the vehicles at parking lot entrances and exits.
 - h. Parking structures: Overview cameras shall show flow of traffic and vehicle descriptions. Cameras shall detect activity at parking gates and on parking levels. Cameras shall show license plates at parking gates.