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This section is currently being revised. Contact Joe Ellerbrock, 979.458.7041, jellerbrock@tamus.edu, or Bruce Karr, 979.458.7042, bkarr@tamus.edu, for the latest version.

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This following items are currently being revised. Contact Joe Ellerbrock, 979.458.7041, jellerbrock@tamus.edu, or Bruce Karr, 979.458.7042, bkarr@tamus.edu, for the latest version.

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Historically Underutilized Business Program

The Texas A&M University System Office of Facilities Planning and Construction is committed to promoting the participation of minority, women-owned, and small businesses through the Historically Underutilized Business (HUB) Program for the procurement of goods and/or services. The procurement process utilized by the A&M System seeks to provide equal opportunity and equal access in the design and construction opportunities on projects managed by Facilities Planning and Construction.

General Information

The “Facility Design Guidelines” is intended as guidance for the project architect/engineer team and the contractor team during the design and construction process for The Texas A&M University System Capital Projects. The content covers specific design criteria, the design process and administrative procedures for permanent buildings on A&M System campuses. Subsets of this document will pertain to renovation, civil, etc. type projects. Many but not all requirements for each Campus or Agency of the A&M System are covered. The Project A/E, CMAR or D-B shall also refer to items covered in their Services Agreement and in the project’s Program of Requirements (POR).

The “Facility Design Guidelines” shall be used along with the project specific Program of Requirements and the Services Agreement.

In the event of conflict between this document and specific project requirements the A/E, CMAR or D-B shall contact the Project Manager with Facilities Planning & Construction for clarification.

The guidelines in this document are not intended to prohibit the use of alternative methods, systems, products or devices not covered in this document. All alternatives shall be documented by the A/E, CMAR and D-B and submitted to the Project Manager for approval by Facilities Planning & Construction prior to implementation.

Throughout these Guidelines under Campus Specific Information there are references to single products and/or manufacturers. These are NOT sole source items. The project A/E is required to identify and include in the documents other products and/or manufacturers that are equal.
Design Philosophy

Design Quality

The Texas A&M University System Office of Facilities Planning & Construction is committed to excellence in the design and construction of buildings for the A&M System Member Universities and Agencies. To accomplish this the Office of Facilities Planning and Construction (FPC) is committed to the highest quality of aesthetics in meeting the requirements of the System Member Universities and Agencies while at the same time delivering a project that is cost effective to operate and maintain throughout its useful life.

All buildings shall be designed with flexibility in mind. Over the life of all major campus buildings the functions will change and the spaces will be reconfigured.

Campus Design Standards

The building design shall follow the guidelines established in the University or Agency Master Plan as well as the guidelines in this document. In the event of a conflict between standards established in a Master Plan and this document the Campus Master Plan shall govern. In lieu of master plan guidelines the design shall blend with campus standards and neighboring buildings. The design shall also conform to neighboring building setbacks, roof lines, etc.

Operating & Building Maintenance

Systems and materials incorporated into buildings should be selected on the basis of long term operations and maintenance costs. The design should incorporate ease and efficiency of operation and allow for easy and cost effective maintenance and repair. Standardization of equipment, parts, and lamps is also the key to reducing maintenance costs and allows for stocking of common replacement parts. The Project A/E should obtain constant feedback from The System Member Facilities Department during design. Detailed instructions from the Project A/E stating the design intent for all building systems and the operating/maintenance procedures are required during the design process.

Sustainability & Energy Performance

The design of all buildings shall incorporate established principles of sustainable design and energy efficiency. Design following these principles improves the buildings performance while enhancing the occupant’s health, satisfaction and performance. Sustainable design is an integrated approach in which all phases of the building life
cycle are considered. The energy performance of the building should exceed any requirements per codes.

**Codes and Standards**

Comply with all state and federal laws applicable to construction. The Project A/E and the FPC Project Manager shall also cooperate with municipalities when tying into local utilities. Codes shall be those adopted by other state agencies, the AHJ or latest edition.

**General Requirements**

The Project A/E shall design A&M System projects to comply with the current editions of the following codes and standards and advise the Owner of code revisions having impact on the project design.

The State Fire Marshal is the code Authority Having Jurisdiction (AHJ) for all issues pertaining to NFPA 1, Fire Code and 101 Life Safety Codes. Texas A&M University Environmental Health and Safety Department has been delegated the AHJ for projects on A&M College Station campus. The System Office of Safety is the delegated code AHJ for all other A&M System campuses. FPC is responsible for facilitating resolution of conflicts and interpretations after a thorough and joint discussion with the A&M System Member.

The Project A/E shall prepare a written codes and standards analysis, “Building Code Analysis,” for each project for review by the AHJ and FPC. This analysis shall provide a side-by-side comparison of the requirements of the listed codes and standards. The comparison shall include all code items and an indication of which code requirement is being applied to the project. In the absence of a careful and thorough discussion by the design team of a specific conflict between the codes, the default is to design to the more stringent or robust code. These code discussions are project-specific and on an item by item basis within the codes. The final approved Building Code Analysis shall be included in the construction documents for future reference.

In the event of the need for interpretation among the codes and standards, the Project A/E shall inform FPC of the need for an interpretation and FPC will establish the requirements for compliance.

Local municipal building codes are not applicable to construction on State of Texas properties, which includes all properties owned by The Texas A&M University System. However, if it is necessary for a local authority to review any aspect of the project, such review shall be arranged by the System Member representative.

FPC may also require the Project A/E to comply with certain provisions from the local
fire department that provides fire protection services for the System Member. These provisions may include locations and dimensions for firefighting access, including fire lanes; locations and specifications for stand pipes, fire hose cabinets, fire control room, and fire hose connections; elevator requirements; and other similar matters.

The Project A/E shall be required to provide a statement that the project is designed in compliance with applicable codes and standards. The following statement shall be included on the general information page adjacent to the project building code summary.

“Life Safety Code Compliance: The Architect/Engineer of Record acknowledges that construction projects for the Texas A&M University System must, at a minimum, be designed in accordance with the requirements of National Fire Protection Association (NFPA) 101, Life Safety Code, as currently adopted by the State Fire Marshal, Texas Government Code sec. 417.008(e). Therefore, the Architect/Engineer of Record affirms that, to the best of his/her professional judgment, knowledge, and belief, the design of this project satisfies the requirements of NFPA 101, Life Safety Code, as well as any other codes or standards made applicable to the project by the professional services agreement.”

**Design Basis**


**Architectural Design**

1. NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals as applicable
4. Fair Housing Act accessibility requirements for housing units.
5. FM Global Standards for roof systems
Civil/Structural Design

1. ACI – 318, building code requirements for reinforced concrete
2. AISC, specification for the Design, Fabrication and Erection of Structural Steel
3. Texas Department of Insurance requirements First Tier Coastal Counties wind load criteria
4. FEMA 100 year flood plain designation
5. TCEQ SWPPP Requirements

Mechanical and Plumbing Design

1. International Mechanical Code latest edition
4. ASHRAE 62.1 Indoor Air Quality Standard
5. FM Global Standards for fire protection systems

Electrical Design


Communications Design

1. TIA/EIA Standards

Energy and Water Conservation Design

   ASHRAE / IESNA 90.1 latest adopted Edition
3. SECO Alternative Energy Evaluation Requirements

Acoustic Design

Design in accordance with good practice to achieve conventional ambient noise levels
qualified in Noise Criteria (NC) defined in current ASHRAE Applications Volume, Chapter 42 and ANSI S1.8 Reference Quantities for Acoustical Levels – ASA 84.

The ambient sound level of an occupied space is not to exceed the following NC listed for its respective typical occupancy unless specifically directed otherwise by the System Member representative or the project Program of Requirements (POR). Spatial forms, materials, assemblies, systems and equipment selections are to be designed as required to achieve a standard quality of specified level of maximum background noise.

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<th>Maximum Noise Criteria (NC)</th>
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<td>Apartment/Dorms</td>
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<tr>
<td>Individual rooms/suites</td>
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<tr>
<td>Meeting/Banquet rooms</td>
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<tr>
<td>Halls, corridors &amp; lobbies</td>
<td>40</td>
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<tr>
<td>Service/support areas</td>
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<tr>
<td>Offices</td>
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<tr>
<td>Executive</td>
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<tr>
<td>Conference Rooms</td>
<td>30</td>
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<tr>
<td>Private</td>
<td>35</td>
</tr>
<tr>
<td>Open plan areas</td>
<td>40</td>
</tr>
<tr>
<td>Business machine areas</td>
<td>45</td>
</tr>
<tr>
<td>Public circulation</td>
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<tr>
<td>Research, Hospital and Clinics</td>
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<td>Private rooms</td>
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<td>Public Areas</td>
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<tr>
<td>Lecture &amp; classrooms</td>
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These conventional standards of the level of ambient noise in a space are independent of and prior to the installation of any Owner-furnished equipment, furniture and furnishings unless specified otherwise.

Other resource material describing conventional ambient noise criteria is available in the current edition of Ramsey/Sleeper Architectural Graphic Standards.
The Project A/E is required to submit sealed documents for an accessibility review. The required review should be accomplished by a Registered Accessibility Specialist located near the project site. The same Registered Accessible Specialist (RAS) will be utilized for the plan review and the post construction inspection.

The A/E will be required to secure permits from state and federal government agencies when necessary, such as Texas Department of Highways and Public Transportation, Health Department, etc. The cost of any permits will be borne by the Owner.

If the project site is along the Texas coast the Project A/E is expected to provide design details and specifications to meet Texas Windstorm certification requirements. The design team will include an individual certified and authorized to make the required design decisions, submittal reviews, and on-site inspections of the building during construction (to include signing the certification documentation) to ensure compliance with the Windstorm certification requirements.

The Project A/E will complete and submit the Energy Conservation Design Standard Certification form for Nonresidential Buildings and compliance forms required by SECO as part of the required Energy Report to the FPC Project Manager.

The project A/E will complete and submit the Energy Conservation Design Standard Certification form for Residential Buildings and compliance forms required by SECO as part of the required energy report to the FPC Project Manager.

Environmental Practices

Sustainable Design

The design shall employ sustainable design principles based on LEED 2009 as established by the U.S. Green Building Council. Specifically employ those principles pertaining to energy and water conservation and indoor environmental quality. Refer to the project POR to determine if the building shall be certified through U.S. Green Building Council. The A/E shall prepare a checklist to determine the theoretical level of certification. The A/E is responsible for updating this checklist and providing updates at project milestones to the project team. These updates shall include explanations of the point changes. All buildings shall be designed to maximize daylighting, maximize human comfort and minimize energy use.

Energy Performance

All new buildings should be designed to exceed the requirements of ASHRAE 90.1-2010 or latest adopted edition. All existing building renovation projects should be designed to exceed the requirements of ASHRAE 90.1-2010 or latest adopted edition. Active design
features that are incorporated to achieve the additional energy savings shall have a life cycle payback calculated. The System Member Facilities Department has final decision on incorporating additional energy conservation features.

Residential projects, as defined by the State Energy Conservation Office (SECO), shall be designed to comply with International Code Council’s International Energy Conservation Code, IECC 2009 or latest adopted edition.

**Daylighting**

In order to maintain a relationship between the building occupants and the outdoors, direct views of the outside should be provided for most of the regularly occupied areas unless the needs of the spaces dictate otherwise. The building design should strive to provide outside views for 100% of all offices in the building.

If daylighting systems, beyond windows, are included in the design for daylight harvesting the project team must take special concern to ensure adequate daylight illumination, avoid common glare issues and fully integrate the lighting and mechanical systems with the interior architecture and daylighting systems.

**Building Materials**

Wherever possible, products, and materials with recycled-content and no volatile organic compounds (VOC) should be specified in the building design.

**Indoor Air Quality**

The design shall follow ASHRAE 62.1- latest edition

**Commissioning**

All building projects shall employ commissioning practices to assure delivery of program goals and related performance requirements. The Project A/E shall coordinate commissioning practices with the FPC Project Manager, the System Member Facilities Department, the Commissioning Authority (if contracted separately) and the contractor (if the delivery method is construction manager at risk or design-build) during design. Commissioning scope and practices are to comply with current FPC standards. The commissioning agent is responsible for updating the BIMs and COBie data with the as-commissioned data produced during the commissioning process.

**Life Cycle Cost Analysis (LCCA)**

**Purpose**
The Texas A&M University System has a long tradition of designing and constructing high quality buildings. Continuing this tradition, Facilities Planning and Construction seeks to ensure that all buildings meet student, faculty and staff needs as efficiently and cost effectively as possible. Cost effectiveness of a design is therefore a key component and Life Cycle Cost Analysis (LCCA) is a design process for evaluating and controlling the initial and future cost of building ownership. Life Cycle Cost Analysis (LCCA) is defined by the National Institute of Standards and Technology (NIST) Handbook 135 as the total discounted dollar cost of owning, operating, maintaining, and disposing of a building or building system over a period of time. NIST Handbook 135 is available at www.bfrl.nist.gov/oae/publications/handbooks/135.html

LCCA is based on the premise that multiple building design options can meet programmatic needs and achieve acceptable performance, and that these options have differing initial costs, operating costs, maintenance costs, as well as different life cycle costs. By comparing the life cycle costs, LCCA can show the trade-offs between low initial first cost and long-term cost savings. Thus, the most cost-effective system for a given use can be identified, and the length of time it will take to “pay back” the incremental cost for this system can also be determined. In keeping with the A&M System’s sustainability practices, LCCA can identify environmentally desirable solutions. Careful design choices that result in efficient use of energy, water and other resources often yield long-term cost savings. In addition, should environmentally friendly choices not save money over time, LCCA may reveal that their additional cost over time is minimal. These guidelines define the LCCA process, and establish the standards and metrics to ensure accurate and consistent life cycle data collection and evaluation across projects.

**General Requirements**

During the Schematic Design (SD) and Design Development (DD) phases of a project, the A/E is required to perform a minimum of three (3) LCCA comparative analyses from several building system categories. Two of the three analyses shall relate to energy conservation. Each LCCA comparative analysis can have up to four (4), or more, alternatives (one base case plus three alternate cases). Building system categories are as follows, but are not limited to:

**Energy Systems**

1. Central plant vs. stand alone system chillers and boilers  
2. Equipment options for stand-alone systems (air cooled chillers vs. refrigerant-based direct expansion [DX] units)  
3. Additional pipe or duct insulation  
4. Alternative energy systems
5. Use of heat recovery systems and other energy saving systems and equipment

**Mechanical Systems**

1. Air distribution systems (variable volume vs. constant volume, overhead vs. under floor).
2. Water distribution systems (various piping systems and pumping options)

**Electrical Systems**

1. Indoor lighting sources and controls
2. Use of natural lighting and day lighting controls
3. Outdoor lighting sources and controls
4. Power distribution (transformers, buss ducts, cable trays)

**Building Envelope Systems**

1. Building skin options (masonry, precast, metal panels)
2. Additional building insulation
3. Roofing systems (types, materials, insulation methods)
4. Glazing, daylight, and shading options

**Building Interior Construction**

1. Floor covering (carpet, terrazzo, tile, vinyl tile)
2. Interior partitions (movable vs. fixed)

**Building Siting/Massing**

1. Orientation, floor to floor height, and overall building height
2. Landscape, irrigation, and hardscape options

**Structural Systems**

1. Systems/materials selection (wood vs. steel vs. concrete, cast-in-place vs. pre-cast)
2. Foundation system (slab on grade, structural, crawl space, drilled piers, auger cast, pilings, spread footings)

**Selecting Cost Effective Alternatives**

Alternatives that result in a payback of 5 years or less should be incorporated into the project. Alternatives that result in a payback of 6 to 10 years are strongly encouraged to
be incorporated into the project. Alternatives with a payback greater than 10 years are optional. The System Member Facilities Department has final decision on alternatives selection.

**LCCA Software**

Project A/E shall use either of the following software programs for LCCA analysis

BLCC – Available from NIST at www1.eere.energy.gov/femp/information/download_blcc.html

User Friendly Life-Cycle Costing – A spreadsheet implementation of BLCC and available at www.doe2.com

**The LCCA Process**

The LCCA process involves the Project A/E and FPC, Physical Plant and Users (Project Team) and requires that they establish clear objectives, determine the criteria for evaluating alternatives, identify and develop design alternatives, gather cost information, and develop a life cycle cost for each alternative.

The Project Team should establish clear objectives in evaluating alternatives. LCCA can capture dollar cost variations between alternatives and show which option has the overall lowest cost.

The two metrics to be used and calculated in the LCCA are the Life Cycle Cost of each alternative and its Payback over an agreed upon study life. Consideration is given to total costs and the time it takes to recover an incremental initial investment incorporating the time value of money. As mentioned above, Life Cycle Cost is defined as the total discounted dollar cost of owning, operating, maintaining, and disposing of a building or building system over a period of time.

The Project Team should develop up to four alternative designs. The first alternative design is the “base case” and is the standard design or minimum requirement for a project. The base case is typically identified as having the lowest initial cost of all the alternatives. The remaining three alternative designs are developed to evaluate against the “base case.” The Project Team should use their experiences and judgment in selecting relevant building and system component alternative designs.

For each alternative design, the Project A/E should gather cost information. Cost information should include, but not be limited to, the following:

**Initial Costs**
1. Construction costs (labor, materials, equipment, etc.)
2. Soft costs (design fees, permit fees, etc.).

**Annual Future Costs**

1. Operating Costs (utility costs such as electricity, gas, water, steam, chilled water, etc. and service costs such as custodial, etc.)
2. Maintenance Costs (preventative and reactive)

**Non-Annual Future Costs**

1. Replacement Costs (planned maintenance, renovation at a future date, etc.)
2. Demolition Costs (if required)

Note: Residual Value default is set at zero ($0) for all studies and not included in LCCA unless otherwise directed.

For each alternative, including the base case, the Project A/E should calculate the LCC and Payback metrics. Each alternative should be evaluated using these two metrics, and recommendations should be made as to which alternative design should be incorporated into the project.

All LCCA efforts should be completed in the Design Development phase of the project. If the design changes during Construction Documents the LCCA shall be modified to reflect the change.
## Building Elements Lifespan

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<th>Commercial</th>
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<tr>
<td>Structural Foundation</td>
<td>80 yrs</td>
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<tr>
<td>Slab on Grade Foundation</td>
<td></td>
<td>50 yrs</td>
<td>30 yrs</td>
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Institutional - Permanent campus buildings

Commercial - Non-educational support buildings or developer building

Apartments - Wood frame student housing
Space Standards

Calculation of Building Areas

The method used to calculate the assignable square feet and gross square feet in a building is based on guidelines from The Texas Higher Education Coordinating Board (THECB). These guidelines are intended to establish common standards for building inventory for all state institutions of higher education. In large part these guidelines are also based on those from the U.S Department of Education, National Center for Education Statistics.

Gross area should be computed by measuring from the outside face of exterior walls, disregarding cornices, pilasters, buttresses, etc., which extend beyond the wall face. The gross area includes all floored spaces from ground level through top floor. It includes basements (except unexcavated portions), attics, garages, enclosed porches, penthouses, mechanical equipment floors, lobbies, mezzanines, balconies (inside and outside) utilized for operational functions, and corridors (provided they are within the outside face lines of the building).

The sum of floor areas of a building included within the exterior walls for all stories or areas that house floor surfaces including attics, basements, sub-basements, penthouses, mechanical rooms, etc. These are areas with six foot six inch clear headroom or areas with lower ceilings that are usable for storage or other purposes.

Gross area does not include open courts and light wells, or portions of upper floors eliminated by rooms or lobbies which rise above single floor ceiling height.

Net Assignable Area is defined as the sum of all areas within the interior walls of rooms on all floors of a building assigned to or available for assignment to, an occupant or use, excluding unassignable space.

Unassignable area of a building is the sum of space within a building not assigned to directly support academic programs. Included in this are:

Building support areas used for the protection, care and maintenance of a building, circulation areas such as corridors and stairwells, Mechanical areas which are areas designed to house mechanical equipment, utility services and shaft areas, Inactive areas space in a building that once was assignable but is permanently no longer in use, shell space or unfinished space designed to be converted into usable space at a later date and public restrooms which are accessible to the public.

Area shall be derived from the BIMs. The A/E is responsible for maintaining the areas in the BIMs.
Building Core Elements

First Floor Elevation

The first floor elevation of all new buildings where possible shall be equivalent to the 500yr predicted flood elevations, plus 2ft. (FEMA flood level predictions are based on a statistical average, with standard deviation of +/-2ft).

Where new buildings cannot be located above the 500yr or 500yr+2ft flood levels, the first floor elevation shall at least 1 to 2 feet above the 100yr flood elevation, and high-value equipment, ornate interior finishes and critical operations or research laboratories should be located on a level above the 500yr+2ft flood elevations.

The storm-water management system shall use grading and drainage sufficient to route predicted rain-water for the 100-yr, 24-hr rainfall event. The system should primarily rely on grading to direct water away from the building, with limited reliance on storm-water drainage systems directly adjacent to building openings or outside equipment. Building designs with below-grade spaces such as basements, service tunnels, etc. are discouraged in areas subject to flooding. Should below-grade service areas or basements be required, they should not have openings located below the 500yr+2ft in areas subject to flooding, or below grade of the surrounding terrain in areas not subject to flooding.

Building Entrances

All main entry points to a building must be provided with a vestibule that performs as an air lock and; have walk-off mats acceptable to The System Member Facilities Department. Weather protection must also be provided for the exterior doors at a minimum this shall consist of door sweeps, weather seals at the door head and jambs, drips at the bottom of the door, and over head rain drips above the door that extend at least 8” beyond the jambs of the door.

Building Circulation

The building circulation system (corridors) should be clearly designed to lead building occupants from entrances to their destination. It is desirable to introduce as much natural light as possible into corridors, through windows, transoms or borrowed light. Utility systems should be routed in circulation pathways to provide access to utilities without disrupting occupied spaces.

Doors on opposite sides of corridors shall be offset to prevent direct viewing from one room to another. Classroom and laboratory room doors opening into corridors shall be recessed the width of the door to eliminate corridor obstructions.
Building corridors are to have sufficient above ceiling space to accommodate all of the required equipment and provide maintenance access and code required clearances to that equipment. The A/E shall establish and distribute for review the above ceiling stratification. The A/E shall also establish routing strategies for equipment that may run at the same elevation in the ceiling plenum on opposite sides of the corridor.

The A/E shall model clearances required for all above ceiling equipment for coordination purposes.

**Crawl Space Under Suspended Structural Foundations**

Where plumbing access or future flexibility is required by the System Member Facilities Department provide an accessible crawl space with 2 inch thick, 2500 psi unreinforced mud slab, properly sloped and drained. Crawl space must be provided with lighting, weather proof electrical outlets, and ventilation (minimum 2 air changes per hour) along with adequate access hatches and access ladders. Access to the crawl can be through floor hatched in the mechanical room or an area way on the perimeter of the building. Access shall not be through electrical rooms, telecommunications rooms, or custodial rooms. Switches for crawl space lighting shall be located near access hatches so that the lighting can be turned on prior to entry. The minimum clearance in crawl space shall be determined by the System Member Facilities Department and the crawl space shall maintain negative pressure relative to the first floor.

**Egress Stairs**

The location and design of egress stairs within buildings should encourage their use for everyday vertical circulation. Magnetic door hold open devices, interconnected to the building fire alarm system, are allowed to keep interior doors to egress stairs in an open position to encourage their use.

**Equipment Rooms**

All mechanical and electrical equipment rooms must be designed with adequate aisle space and clearances around equipment to accommodate maintenance from the floor and replacement of items. There must be a defined pathway from all equipment rooms to the building exterior of adequate size to permit the replacement of equipment. Means of removal of equipment shall be by the most cost efficient path approved by The System Member Facilities Department. Plans and elevations for all equipment rooms, at a scale not less than $\frac{1}{4}'' = 1'-0''$, shall be prepared for each room to indicate that adequate circulation and maintenance areas are provided. The A/E shall model all required clearances and pulls required for maintenance and repair of equipment for coordination purposes. All equipment rooms must be designed to control noise transmission to
adjacent spaces including corridors. Depress the floor of all mechanical rooms 1-1/2 inches and uniformly slope the entire floor to minimum 4 inch floor drains connected to the building sanitary sewer system.

**Electrical Closets**

Electrical closets must be designed so that three walls stack vertically and NO wall is centered on a structural beam that would interfere with vertical risers. Do not route building utility capable of conveying liquids through or above electrical closets. The only exception allowed is the branch sprinkler line serving only the sprinkler head in an electrical closet. NFPA 13 allow the electrical closet to be unsprinklered if a 2 hour wall and door are used. Access to electrical closets must be from within the building from the corridor system and not through any other space. Door should open out from space to maximize usable interior floor and wall area.

**Main Switchgear room**

The main electrical switchgear room for a building should be located on the ground floor. It shall never be located below restrooms, custodial closets or at an elevation that requires sump pumps for drainage. The layout of the room shall comply with the National Electric Code requirements for minimum clearances.

**Communication Closets**

Communication closets must be designed so that all four walls stack vertically and NO wall is centered on a structural beam that would interfere with vertical risers. Communication closets must be provided on each floor and located such that no wiring run exceeds 270 feet. Any exceptions must be approved by the System Member IT Department. A single communication closet can generally serve 10,000 square feet of floor space. Access to communication closets must be from within the building from the corridor system and not through any other space. Door should open out from space to maximize usable interior floor and wall area.

**Air Handler Rooms**

Air Handler rooms should be designed so that they stack vertically and NO wall is centered on a structural beam that would interfere with vertical risers. The spaces must be arranged and sized to provide maintenance staff with safe access to all pieces of equipment for routine maintenance. Access to air handler rooms must be from within the building from the corridor system and not through any other space. Door should open out from space to maximize usable interior floor and wall area. Provide a minimum of 2 feet clearance on two sides and one end of the air handlers. Provide
clearance for removing coils and filters. These clearances shall be modeled for coordination purposes. Air handler rooms shall be insulated for sound.

**Rest Rooms**

Rest rooms must be located on each floor and should be located within 200 feet of every occupied space. Rest rooms should be grouped with custodial closets for ease of maintenance and to reduce plumbing runs. Rest rooms should be sized to accommodate a minimum fixture count determined by the International Plumbing Code (IPC) and accessibility based on the Texas Accessibility Standards. Rest rooms serving assembly areas must accommodate short term, high volume traffic and will require higher fixture counts. Also, the number of fixtures for women’s rest rooms shall be higher than minimum determined by the IPC. The increase will vary according to project and campus, up to a fixture ratio of 1/3 men to 2/3 women. Confirm fixture count with the System Member Facilities Department. Either the built in trash receptacle shall be located adjacent to the restroom door or there shall be floor space available next to the door for the placement of a large trash can.

All high traffic restrooms on ground floor shall be designed with airport style entry (no doors) and trash receptacles of adequate capacity for traffic volume.

Direct or reflected lines of sight into restrooms and dressing rooms from the corridor are prohibited.

Provide at least one accessible family friendly restroom containing one water closet, one lavatory and a diaper changing station. Location should be adjacent to building entrance or elevator lobby on first floor.

**Loading Dock**

Provide a loading dock at each new building. The loading dock and service yard shall be screened from major streets and views. Refer to the POR and Facilities Department for specific requirements for loading dock.

**Trash Dumpsters/Trash Compactors**

Provide a concrete pad either in the loading dock service yard or a separate screened enclosure for trash dumpsters. Refer to the POR for any specific requirements for dumpsters or the need for a compactor. Refer to the Facilities Department for the type of dumpsters used, access requirements, and any other equipment or area requirements that may be needed for the equipment.

**Recycling Room**
A recycling area should be provided for each building located adjacent to the loading dock or service entrance. This space will allow for sorting of recyclables such as paper, glass and metals. Refer to the local Facilities Department for details on campus recycling programs.

**Custodial Closets**

Should consist of 80 sq. ft. minimum floor space, include shelf, mop sink and hand operated eye wash. The minimum clear width of a custodial closet is six feet. A closet of this size can serve a floor area up to 50,000 gross square feet (gsf). Building designs with floor areas larger than 50,000 gsf shall require more than one custodial closet per floor. Door should open out from closet to maximize usable interior floor and wall area. Custodial closets shall not have telephone, cable television, data, mechanical or electrical cables or equipment in it nor roof or under floor access through it. The custodial closet should be located near the restrooms on each floor.

Smaller custodial closets approved by FPC Project Manager and Facilities Department may be utilized in outlying small buildings but they should have the basic items such as mop sink, shelving, mop and broom hangers, and room enough to store cart and floor buffer. These custodial closets should have an area of not less than fifty (50) square feet and a minimum clear width of five feet.

Custodial closet shall contain the following:

1. Standard 2'x2'x8" floor corner mounted mop sink located close to door.
2. Wall surface materials around the mop sink must be moisture resistant.
3. Provide six mop hangers, above the mop sink and twelve mop and broom hangers along wall near the mop sink. If mop hanger has an integrated shelf it should be mounted 72 inches minimum above finish floor.
4. Provide shelving on one side wall, at least four 12" shelves 16" to 18" apart with the bottom one being mounted approximately two feet above the floor. Adjustable heavy duty shelving systems are acceptable.
5. Overhead fluorescent lighting controlled from switch just inside door.
6. One electrical duplex outlet on each side wall. Use GFI outlets where required by code when placed near a water source.
7. Wall hung lavatory near door with hand held eye wash.

**Server Room Requirements**

Almost every building has a requirement for one or more server rooms. Some buildings house mission critical servers and as such have more stringent environmental requirements. The size and intensity of a server room is not usually known during the
concept or design phase of a building. Due to rapid advances in technology, the equipment that served as a basis for design is not the equipment that will be installed at owner occupancy. The trend has been for servers to get smaller in physical size yet increase the quantity of power supplies and heat rejection into the space. Thus more equipment with a greater heat and power load is being placed into spaces that were not designed to handle either the power or thermal loads.

Some installations have electrical power installed at levels of 20 kW per rack. While this may be excessive in a university environment, there are some universities that have started using these design criteria. In an effort to anticipate some of this effect, provide the following:

1. Each server room shall be furnished with an electrical service that equals at least 200 watts per square foot. This works out to approximately 7 kW per rack. Some spare capacity must be included. Present design criteria require about 3 kW per rack. A computer grade panel board should be furnished in each server room.
2. Each server room should be served from a standby generator. As the servers become more mission critical this requirement becomes essential.
3. The thermal requirements for all server rooms should be supplied first from the building thermal utilities with humidity control and secondary back up in the form of an independent DX system. The power for the secondary system should be from a standby generator. Special consideration should be given to consolidating server rooms into one centralized server room. Server rooms should be designed with sufficient capacity to operate at 48 degree chilled water supply to meet planned and future loads.
4. Each server room must have some form of entry access control.
5. If the server rooms are unmanned and remote some form of environmental monitoring and alarm should be provided.
6. The server room minimum width shall be 11’ based on a single row of racks in the center of the room. The length shall be determined by the number of racks plus the required circulation space on each end.
7. Racks of back-up batteries supporting UPS and other back-up systems should be located in a separate Battery Room, with no normal opening between the two areas. Lead/Acid batteries that overheat release corrosive by-products that can deposit chemical residues on computer equipment circuitry that requires extensive decontamination or replacement. Overcurrent protection should be provided.

While the power and thermal requirements are considerably less, the telecom closets should be likewise provisioned. There are other applications that require increased consideration for reliability and environmental controls that must be evaluated on a case by case basis.

**Floor and Space Identification Systems on Drawings**
Each space shall be identified by name as identified in the POR or as agreed to by the FPC Project Manager and the User Coordinator and room number.

Room numbers used in the Construction Documents will become the actual and permanent space numbers.

All equipment placed in or above a space shall use the space and floor number as identifying parametric data.

**Assignment of Floor Numbers**

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. Third and subsequent floor shall be numbered in a similar manner. Basement level shall be numbered 001 series.

**Assignment of Room Numbers**

The rooms on each floor opening off of either side of a corridor shall be numbered consecutively in a clockwise direction from the primary entrance which shall be 100. If there is more than one main entrance to the building use the one mutually agreed to by the FPC Project Manager and the User Coordinator.

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.

Corridors, vestibules and other areas and spaces which have not been assigned numbers by the Campus maybe assigned numbers for completing room finish schedules and for use in reference notes and correspondence. These numbers are not to be considered permanent numbers.
Campus Specific Information

Texas A&M University

Design Review Sub-Council

All projects shall be submitted to the Design Review Sub-Council (DRS) for alignment with the design principles in the campus master plan. The final report of the 2004 master plan can be found at the following link:
http://cbe.tamu.edu/drsc-documents.aspx

The exterior design and materials shall be presented to the DRS beginning with schematic design. The project will be evaluated based on a master plan design checklist for new buildings. A copy of the checklist can also be found at the following link: 
http://cbe.tamu.edu/drsc-documents.aspx

After each presentation the DRS will provide comments and a report on how the project aligns with the checklist.

The project shall also be presented to the DRS at Design Development and during Construction Documents. When all items in the checklist are shown to be aligned or not applicable the project can proceed to bidding phase.

Energy Performance

All new buildings shall be designed to exceed the requirements of ASHRAE 90.1-2010 by 14% and 11% in existing building renovations. Energy modeling by the project team will be required to verify energy performance of buildings.

Life Cycle Cost Analysis (LCCA)

The Project A/E shall refer to Utilities & Energy Services – Design Standards & Guidelines for additional information. This can be found at https://utilities.tamu.edu/design-standards/

Commissioning

The Project A/E shall coordinate commissioning practices with the FPC Project Manager, Utility & Energy Services, the Commissioning Authority (if contracted separately) and the contractor (if the delivery method is construction manager at risk or design-build) during design.
Family Rooms

Provide at least one family rest room containing one fixture, one lavatory and one diaper changing station. Locate on ground floor near other rest rooms.

Maintenance Service Area

In all building at Texas A&M University, for every 25,000 gsf of building area 50 nsf shall be set aside as a maintenance service area. This space shall be located on the first floor level near the service entrance and loading dock.

Vending Standards

1. Provisions for vending machines should be considered in new buildings with occupancies greater than 25 people.
2. At a minimum, space should be allocated for 3 vending machines. Allow 4ft. wide x 4ft. deep for each vending machine. For recessed or alcove applications with ceiling drops, allow minimum 7 ft. clear height for vending machines.
3. Vending areas should be located in spaces that are readily visible to the public, both occupants and visitors. Vending should be located along the most frequently and highly traveled traffic areas in the building. Vending signage is helpful, but location of machines is more critical.
4. Provide a dedicated GFCI duplex receptacle (on separate 20 amp breaker) for each vending machine. Receptacles should be located directly behind each machine. Refrigerated soft drink machines will average 10 to 13 amps when compressor is running. Compressors can pull up to 30 amps for a few seconds during start-up.
5. Provide a data drop for debit card (Aggie bucks) readers on vending machines. Run conduit to communications room in the building.
6. Accessible routes should be considered for installation and servicing of vending machines. Ground floor locations are preferred on two story buildings. Elevator access is required on second floor and above locations. Access and docking or parking for vending product (truck) deliveries to the building should be provided. Ramps should be provided for dolly traffic on approaches to service entrances.
7. Provide space for trash containers and recycling container (aluminum cans) in or near vending areas.
8. If provided as a part of project, vending machines shall be compliant with Energy Star Program Requirements for Vending machines to ensure minimum energy consumption.
West Texas A&M University

Main Switchgear Room

At WTAMU basement or below grade main electrical switch gear rooms are acceptable with walls separating it from other building functions.

Maintenance Service Area

In all building at WTAMU, for every 25,000 gsf of building area 50 nsf shall be set aside as a maintenance service area. This space shall be located on the first floor level near the service entrance and loading dock.

Vending Standards

1. Provisions for vending machines should be considered in new building with occupancies greater than 25 people.
2. At a minimum, space should be allocated for 3 vending machines. Allow 4ft. wide x 4ft. deep for each vending machine. For recessed or alcove applications with ceiling drops, allow minimum 7 ft. clear height for vending machines.
3. Vending areas should be located in spaces that are readily visible to the public, both occupants and visitors. Vending should be located along the most frequently and highly traveled traffic areas in the building. Vending signage is helpful, but location of machines is more critical.
4. Provide a dedicated duplex receptacle (on separate 20 amp breaker) for each vending machine. Receptacles should be located directly behind each machine. Refrigerated soft drink machines will average 10 to 13 amps when compressor is running. Compressors can pull up to 30 amps for a few seconds during start-up.
5. Provide rough-in for debit card (Buffalo Gold Card) readers on vending machines. Rough-in to include a wall mounted duplex box with ½” conduit and pull string stubbed above ceiling. Buffalo Gold Card uses Cat 5 UTP Ethernet communication cables (gold jacket). All communication cable shall be run from the communications room demark to the wall mounted duplex box. If there is more than one duplex box (for a bank of vending machines) the wire shall “LOOP” through “continuously” in a single run from one duplex box to the next leaving at least 12’ of loop wire at each box.
6. Accessible routes should be considered for installation and servicing of vending machines. Ground floor locations are preferred on two story buildings. Elevator access is required on second floor and above locations. Access and docking or parking for vending product (truck) deliveries to the building should be provided. Ramps should be provided for dolly traffic on approaches to service entrances.
7. Provide space for trash containers and recycling container (alum. cans) in or near vending areas.

Texas A&M University-Texarkana

Maintenance Service Area

In all building at Texas A&M University-Texarkana, for every 25,000 gsf of building area 50 nsf shall be set aside as a maintenance service area. This space shall be located on the first floor level near the service entrance and loading dock.

Vending Standards

1. Provisions for vending machines should be considered in new buildings with occupancies greater than 25 people.
2. At a minimum, space should be allocated for 3 vending machines. Allow 4ft. wide x 4ft. deep for each vending machine. For recessed or alcove applications with ceiling drops, allow minimum 7 ft. clear height for vending machines.
3. Vending areas should be located in spaces that are readily visible to the public, both occupants and visitors. Vending should be located along the most frequently and highly traveled traffic areas in the building. Vending signage is helpful, but location of machines is more critical.
4. Provide a dedicated GFCI duplex receptacle (on separate 20 amp breaker) for each vending machine. Receptacles should be located directly behind each machine. Refrigerated soft drink machines will average 10 to 13 amps when compressor is running. Compressors can pull up to 30 amps for a few seconds during start-up.
5. Provide a data drop for debit card readers on vending machines. Run conduit to communications room in the building.
6. Accessible routes should be considered for installation and servicing of vending machines. Ground floor locations are preferred on two story buildings. Elevator access is required on second floor and above locations. Access and docking or parking for vending product (truck) deliveries to the building should be provided. Ramps should be provided for dolly traffic on approaches to service entrances.
7. Provide space for trash containers and recycling container (aluminum cans) in or near vending areas.
8. If provided as a part of project, vending machines shall be compliant with Energy Star Program Requirements for Vending machines to ensure minimum energy consumption.
General Information

The following Division 0 Sections have been developed by Facilities Planning & Construction and are to be utilized on all A&M System projects. The FPC Project Manager will provide the Project A/E with a final copy of all Division 0 Sections for insertion into the project specifications.

If the Project A/E has additional sections or changes to these sections these items shall be brought to the attention of the FPC Project Manager. If the additions or changes are agreed upon then the final copy supplied by the FPC Project Manager will reflect the agreed upon items.

In no event will the Project A/E modify the final sections supplied by the FPC Project Manager.

The following is a listing of the standard Division 0 Sections for Construction Manager at Risk and Design-Build delivery methods:

Guaranteed Maximum Price Proposal
Performance Bond, Form C-6A
Payment Bond, Form C-6B
Uniform General and Supplemental Conditions, Form C-8
Special Conditions and Wage Rates
Soil Investigation Data

The following is a listing of the standard Division 0 Sections for Competitive Sealed Proposal delivery method:

Request for Competitive Sealed Proposal
Instructions for Competitive Sealed Proposal, Form C-3 CSP
Supplemental Instructions for Competitive Sealed Proposal
Bid/Proposal Bond, Form C-2
Part 1, Competitive Sealed Proposal
Part 2, Proposer’s Qualifications
Part 3, HUB Subcontracting Plan
Post Proposal Amendment
Addenda
Contract, Form C-5a
Performance Bond, Form C-6A
Payment Bond, Form C-6B
Uniform General and Supplemental Conditions, Form C-8
Special Conditions and Wage Rates
Soil Investigation Data
General Information

The following Division 1 Sections have been developed to work with the Uniform General and Supplemental Conditions and the Special Conditions and are to be utilized on all A&M System projects. The FPC Project Manager will work with the Project A/E to complete Section 01 11 00 – Summary of Work and Section 01 23 00 – Alternates. The FPC Project Manager will provide the Project A.E with a final copy of all Division 1 Sections for insertion into the project specifications.

If the Project A/E has additional sections or changes to these sections these items shall be brought to the attention of the FPC Project Manager. If the additions or changes are agreed upon then the final copy supplied by the FPC Project Manager will reflect the agreed upon items.

In no event will the Project A/E modify the final sections supplied by the FPC Project Manager.

The following is a listing of the standard Division 1 Sections:

01 11 00 - Summary of Work
01 23 00 - Alternates (CSP Only)
01 25 00 - Substitution Procedures
01 25 00 - Contract Modification Procedures
01 29 00 - Payment Procedures
01 31 00 - Project Management and Coordination
01 31 26 - Electronic Communications
01 31 50 - Project Meetings
01 32 00 - Construction Progress Documentation
01 33 00 - Submittal Procedures
01 42 00 - References
01 43 00 - Quality Assurance
01 45 00 - Quality Control
01 50 00 - Temporary Facilities and Controls
01 60 00 - Product Requirements
01 72 50 - Field Engineering
01 73 50 - Cutting and Patching
01 74 00 - Cleaning
01 77 00 - Closeout Procedures
01 78 00 - Closeout Submittals
01 78 20 - COBie
General Information

Survey

A topographic survey will be performed for each project involving new construction and for renovation projects where necessary by a surveyor licensed in the State of Texas.

The survey shall include information for, but not limited to, topography, existing construction (buildings, roads, sidewalks, etc.), existing utilities on site including closest point of connection if not on site, significant vegetation, easements, etc.

The survey shall be drawn using a BIM authoring program and final copy shall be plotted. The survey shall be modeled at 1:1 scale. All dimensions and elevations shall be in English units. The plotted scale shall be 1.0” = 20.00’ and the title block shall include the project name and project number. The final drawing shall be sealed by a Texas RPLS, if requested. Upon completion of the survey provide two copies of the plotted survey and one DVD or CD-ROM containing the native CAD file, an IFC copy of the file, as well as an ASCII file of the point elevations. The CD shall be professionally labeled containing project name and project number.

Specifically the Survey Shall:

Include a legend of symbols and abbreviations used on the drawing, a north arrow and a graphic scale.

Provide contours at 1 foot intervals unless directed otherwise by the System Civil Engineer with an error not to exceed 1/2 contour interval.

Provide at least two horizontal and one vertical control points with description and elevation to nearest .01’. Datum shall be NAD 83 for horizontal and NGVD 88 for vertical.

Provide spot elevations at street intersections and curb, crown of roads, sidewalks, edge of paving including far side of paving, drainage flow line, manhole rims/covers, top and bottom of retaining walls, etc. Spot elevation on paving or other hard surface shall be to the nearest .05’ and spot elevations on other surfaces to the nearest .1’

Include the location of above and below ground structures, man-made and natural features; all floor elevations and finish floor elevations at each entrance of buildings on the property, if applicable.

Include the location, size and depth of water, gas and thermal utilities. For depths, coordinate with the Facilities Department.

Include the location of fire hydrants available to the property and the size of the main
serving each.

Include the location and characteristics of power and communications systems above and below grade.

Include the locations, size, depth and direction of flow of sanitary sewers, combination sewers, storm drains and culverts serving or on the property; location of catch basins, manholes, and inverts of pipe at each.

Provide the name of operating authority of each utility. Utility information can be provided by the Facilities Department. Additional information will also be provided by Facilities Planning Division.

Provide the mean elevation of water in any excavation, well or nearby body of water.

Provide the location of 1% annualized potential and 0.2% annualized potential (100yr & 500-yr) floodplains.

Provide the extent of watershed onto the property.

Provide the location of trees along with the species name in English, the caliper in inches and the canopy width.

Provide the perimeter outline only of any thickly wooded areas unless otherwise directed.

Show boundary lines, giving length and bearing (including reference or basis) on each straight line; interior angles; radius, point of tangency and length of curved lines. Where no monument exists, set permanent iron pin (monument) or other suitable permanent monument at property corners; drive pin into ground to prevent movement, mark with wooden stake; state on the drawing(s) whether corners were found or set and describe each.

Survey shall be reviewed by FPC Project Manager and Facilities Department before being finalized.

**Hazardous Materials Assessment**

Hazardous Materials Assessments will be considered on a project by project basis. The A/E may need to include in the reimbursable services portion of the A/E Services Agreement the cost for hazardous materials assessments for asbestos, lead, mold or any other materials. The hazardous materials assessment firm is to possess all of the licenses, registrations and qualifications to perform services in the State of Texas.
Geotechnical Investigations

If included as a reimbursable service in the A/E Services Agreement the A/E shall include the services of a qualified Geotechnical firm.

Proposal for Geotechnical Services

Borings proposed by the geotechnical engineer are to be indicated on a map with depths.

Where drilled piers are involved, provide a separate hourly rate and a not to exceed cost (based upon 1 trip and 8 hours of time) to be onsite during the first day of pier drilling to verify bearing stratum and other field conditions.

Schedule of rates are to be attached to proposal.

Drilling & Sampling Methods

Drilling and sampling in accordance with current applicable ASTM standards.

Samples taken at ground surface, at two feet below existing grade and at each change in soil stratification or soil consistency, but not further apart than five feet in each of the borings unless specified.

Rock cores, if applicable are not to be less than 1 3/8" in diameter.

Samples shall be preserved and filed logs prepared by an experienced soil technician.

Make any necessary pavement repairs of like material.

Field & Laboratory Reports

All parts of the report are to be made on white or off white paper measuring 8 1/2 x 11 inches, suitable for photocopying and bound in booklet form. If larger drawings are absolutely necessary, they shall be folded to 8 1/2 x 11 inches to fit into the report booklet.

Written reports and analysis shall be on geotechnical firm's letterhead.

Include with the report a chart illustrating the soils classification criteria and the terminology and symbols used on the boring logs.

Identify the ASTM or other recognized standard sampling and test methods utilized.
Provide a plot plan with horizontal location and ground elevation of test borings using same datum as survey.

Provide vertical sections for each boring plotted and graphically presented showing the number of borings, sampling method used and date of start and finish.

Soil classified in the field logs in accordance with current applicable ASTM and other standards.

Surface elevation at all bores.

Description of soil and thickness of each layer

Hydraulic pressure required or number of blows per foot (N value) and where applicable

Depth to loss or gain of drilling fluid

Depth to wet cave-in

Depth to artesian head

Ground water elevation and time when water reading was made (repeat observation after 24 hours)

Presence of gases.

Location of strata containing organic materials, wet materials or other inconsistencies that might affect engineering conclusions.

Description of the existing surface conditions and summarize the subsurface conditions

As a minimum, the following tests are to be performed: Moisture Contents, Atterberg Limits, Percent Passing #200 Sieve, Hydrometer, Pocket Penetrometer, Unconfined Compression and Unit Dry Weight.

**Foundation Evaluation & Recommendations**

Foundation support of the structure and slab, including soil bearing pressures, bearing elevations foundation design recommendations, including drilled piers/auger cast piles, potential vertical rise and anticipated settlement.

Anticipation and management of groundwater.
Lateral earth pressures for design of walls below grade, including backfill, compaction and sub drainage and associated requirements.

Soil material and compaction requirements for site fill, construction backfill and for the support of structures and pavements.

**Pavement Design**

Design criteria for temporary excavation, temporary protection such as sheet piling, underpinning and temporary dewatering system.

**Stability of Slopes**

Analysis of soils to ascertain presence of potentially expansive, deleterious, chemically active or corrosive materials or conditions or the presence of gas.

**Deliverables**

Two final reports sealed by a Texas Registered Professional Engineer with the project name and project number on the cover page and one DVD or CD-ROM with the report in Acrobat “PDF” format. The PDF shall contain a Table of Contents linked to the corresponding pages.

**Demolition**

All site demolition shall be indicated on a separate demolition plan indicating all items to be turned over to the Facilities Department and all trees and vegetation that shall remain and be protected during construction.

Perform all demolition of existing surface and underground facilities/improvements as required to construct the project. Demolition plans/details shall be included in the design drawings. Underground facilities shall be removed as required to clear construction and in accordance with good prudent practice and considering potential future construction. At a minimum all structures shall be removed to a point 3' below natural ground. All cavities left below ground shall be filled with compacted native material or a flowable fill material. The portions of piping systems remaining in place shall be neatly cut and capped/plugged. Where partial demolition occurs the remaining portions shall be left in a finished functional condition.

Fill all voids left by clearing and demolition operations with native material compacted in maximum 8" lifts to a density equal to that of the surrounding undisturbed soil.
Tree Protection

Provide adequate tree protection around all trees in project site that are to remain. Also, refer to Division 1 for additional information.
General Information

Concrete

All concrete shall be designed, transported, placed, finished and cured in accordance with American Concrete Institute (ACI) requirements. Components of the concrete mix shall meet applicable ANSI/ASTM requirements. Mix requirements and strength shall be specified by the Design Team for each item of construction. Limit the number of mix strengths specified as much as practical.

Concrete form work shall meet applicable ACI requirements.

Concrete reinforcement material, design and placement shall meet the applicable requirements of ACI and the Concrete Reinforcing Steel Institute (CRSI) along with associated ASTM requirements. Reinforcing bars shall typically be Grade 60. No welded wire fabric reinforcing is allowed except in topping slabs or unique situations as approved by the FPC Project Manager. Main reinforcing bars to be minimum No. 4 in size. Limit No. 3 bars (Grade 40) to ties and dowels.

Admixtures to the concrete mix meeting applicable ANSI/ASTM specifications may be used as recommended by the structural engineer to improve concrete workability, wear/weather resistance characteristics, etc., to better meet project conditions. Pozzolan Admixtures should used only within the limits recommended by the structural engineer and approved by the Owner.

The project specifications shall clearly establish finish measurement tolerances/standards suitable to the intended use of the surface and its exposure along with other quality control requirements needed to verify the concrete meets the specifications.

Curing compound manufacturer is to provide certification that their product is compatible with the finish flooring scheduled for the space.

The CM/GC is responsible for creating a BIM of the cast-in-place concrete building structure from which shop, fabrication, and as-built drawings shall be derived.

Void Space Below Grade Beams

Provide soil retainers at face of grade beams below grade to form a void of sufficient depth to prevent expansion of earth to cause pressure on bottom of beams. Acceptable product is SureRetainer by MotzBlock.
General Floor Loading

Design floor live loads on all institutional buildings to carry a minimum of 100lbs/sf unless greater is required by Code and/or use for a particular space such as library shelving. This allows flexibility of future design when the building is renovated. Floors must be designed sufficiently rigid to prevent objectionable vibration. All other buildings the design live loads shall be by the building code.

Porches and Steps

All stoops, porches, ramps, docks and steps, exterior and interior should have non-slip surfaces and nosings where applicable. Slope exterior porches and treads where allowed by Texas Accessibility Standards to drain water. Ponding of water in these areas is unacceptable. Exposed concrete finished work shall be accomplished in two pours: the first structural and the second being a two inch minimum finish topping poured near completion of project.

Primary entry floors may not be constructed using brick or pavers since these surfaces are excessively noisy when carts are rolled across them.

Cement Finished Floors

Generally cement finished floors are to receive hardener with colorant. Positive protection is to be provided to prevent staining and chipping during construction work. Slick finishes shall be avoided.

Crawl Space Under Suspended Structural Foundations

Where a crawl space is included in the design provide a 2 inch thick, 2500 psi unreinforced mud slab, properly sloped and drained. (For further information see General Information “Crawl Space Under Suspended Structural Foundations”).

Concrete Reinforcing

No welded wire fabric shall be used for reinforcing concrete except in topping slabs. All other reinforcing shall be by bars.

Precast, Tilt-up and/or Special Finished Concrete

On projects designed for precast, tilt-up and/or special finished concrete, the Specification shall require a sample panel, constructed all as specified, or at least 42 square feet to be erected at the jobsite for approval consideration by the Director of Project Delivery. The approved panel shall remain on the jobsite as a visual criterion which the final construction must match.
Roof Decks

The preferred material for flat roof decks is concrete. Where the roof is supported by a combination of structural steel, steel joists and steel deck, the topping shall be standard weight concrete.

The main slope for the roof shall be accomplished by the structural system. Only secondary slopes can be accomplished by the roof system.

Mow Strips

Include a 2' wide x 4" thick continuous reinforced concrete mow strips around the building in grassed areas which will require mowing. The mow strip shall be doweled to the building foundation at all door locations. At all other locations the mow strip shall not be doweled to the building foundation unless approved otherwise by the System Civil Engineer.

Include a mow strips along and doweled to the back of curb in grassed areas adjoining head in parking areas which are subject to car bumper overhang. Mow strip to be sloped in the direction of drainage. Jointing shall be provided to match that in the adjoining curb.
General Information

Brick

Brick masonry to be designed and constructed per the standards of the Brick Industry Association.

Brick Selection Procedure

Brick will be selected during project design and shall be specified in the bid documents.

Face Brick shall be ASTM C216; Type FBS grade SW.

In the drawings the A/E will provide a detail that indicates the size of the brick mock-up panel that will also contain all exterior materials such as stone, cast stone, curtain wall, glazing, sealants, etc. for final approval of brick color as well as all exterior colors for the project.

The A/E shall require, in the Project's Specification along with a detail in the drawings, that prior to ordering brick, the Contractor shall erect a 300 brick sample panel in mortar, all as specified, at the jobsite for final approval consideration by the Director of Project Delivery or designee.

The approved panel shall remain on the jobsite as a visual criterion which the final construction must match.

Mortar shall be Type N with concave tooled joints.

Expansion joints and control joints in masonry veneer walls shall be appropriated detailed and shown on building elevations. Extra precautions shall be taken at Texas A&M International University due to extreme summer temperatures.

Concrete Masonry Units (CMU)

Concrete masonry units shall be used wherever feasible for back up to exterior face brick.

Concrete masonry units shall comply with ASTM C90.

Use bullnose type concrete masonry units at all edges and exterior corners.

Stone
Limestone shall be no closer than 4 inches to grade when adjacent to lawns and planting areas. Interior limestone masonry shall be sealed.

Marble and granite shall be domestic.

Anchors, dowels and other accessories used in setting stone shall be stainless steel.

**Overhead Masonry**

Construction where the masonry units are supported overhead using concealed mechanical devices in tension, or where the units extend beyond lower courses using concealed mechanical support devices in tension shall not be used. Building being renovated where these conditions exist shall be thoroughly examined for safety and a report of condition provided.

**Masonry Accessories**

Mortar net or a comparable mortar collection product shall be added to the base of brick veneer and single wythe concrete masonry walls to prevent clogging of weep holes.

**Campus Specific Information**

**Texas A&M University**

**Brick**

Acme Brick: ELP Blend No. 172 Modular Velour Paloma Grey
Acme Brick: PEP Blend No. 250 Modular Velour Royal Oak
Boral Brick: Stone Castle #103
Interstate Brick: Modular Velour Valley Tan
Interstate Brick: Modular Velour Tumbleweed

**Cut Stone**

Cordova Cream Texas Limestone

**Cast Stone**

Cast Stone shall be mixed thoroughly dry as follows: One (1) sack Atlas White Portland Cement with one (1) oz. of Lanbert 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. Stone should match stone on TAMU Northside Parking Garage.

Tarleton State University

Brick

Acme Brick: Eureka Plant EBP 635
Product Code 288880121
Brick Colors 230, 240, 241 and 260
Modular Only

Color blends percentage vary depending upon final building location on campus and shall be field verified.

Blend Rates:
Color 230 – 60-70%
Color 240 – 10%
Color 241 – 15-25%
Color 260 – 5-15%

Renovations to Existing Buildings – Brick colors shall be field verified. Note: Some of the older buildings have the older brick which is more of an orange brick.

Prairie View A&M University

Brick

Acme Brick: TUP Blends No. 2-25%, 3-30%, 5-35% and 20-10% Modular Velour
Acme Brick: EUR Blends No. 230-25%, 240-25%, 260-30%, 241-20% Modular Velour
Cloud Ceramics: Navajo Blend Modular Velour

Texas A&M University at Galveston

Brick

Acme Brick: PEP Blend No. 30 – Dove Grey
Texas A&M University-Corpus Christi

Brick

Acme Brick: PEP Blend No. 58 Shamrock Modular Velour with white mortar
Interstate Brick: Arctic White Modular Velour with white mortar
D’Hanis Brick: Accents Only

Texas A&M International University

Brick

Acme Brick ELP Blend No. 130 Heritage Americana
Acme Brick Blend No. 218 Scratched Face

Cut Stone

Honed Buff Light Range Lueders Limestone, quarried by Featherlite, Texas Quarries Division, Austin, Texas
Dolomite Limestone quarried by Valders Stone and Marble, Inc., Valders, Wisconsin.

Texas A&M University-Kingsville

Brick

Acme Brick ELP Blend No. 154 Sierra
Acme Brick ELP Blend No. 102 Yellow/Tan Martini

West Texas A&M University

Brick

Brick and exterior surface colors shall follow the color pallet of the brick and stone on Old Main Building.

Texas A&M University-Commerce

Brick

Acme Brick Blend No. 4 Modular Velour Windsor Park
Texas A&M University-Texarkana

Brick

Acme Brick TUP Blend No. 20 50% and
Acme Brick TUP Blend No. 33 50%
General Information

Structural Steel

The contractor shall be required to provide an affidavit, at the completion of the project, that the structural steel framing is plumb and level within the normal tolerances specified in the AISC Code of Standard Practice.

The main slope for the roof shall be accomplished by the structural system. Only secondary slopes can be accomplished by the roof system.

The CM/GC is responsible for creating a BIM of the structural steel from which shop, fabrication, and as-built drawings shall be derived.

Cold-Formed Metal Framing

Cold-formed metal floor and wall framing shall be spaced 16 inches on center, maximum.

Metal Fabrications

All exterior ferrous metals shall be hot dip galvanized.

Wherever dissimilar metals come in contact with each other, they must be separated with an approved layer of bituminous coating. Galvanized metal or zinc plated fasteners shall not be used to anchor aluminum or copper. Use aluminum or copper fasteners.

Metal Stairs

Metal stairs with concrete, terrazzo or other similar treads are acceptable for use as egress stairs.

Lightning Protection System

Ensure lightning protection system is designed to prevent galvanic corrosion between dissimilar metals. Do not use a combination of materials that for an electrolytic couple.
Campus Specific Information

Texas A&M University at Galveston
Texas A&M University-Corpus Christi

All exposed exterior ferrous metal shall be stainless steel.

Kynar finish on exterior pipe railings is not allowed.
General Information

Consider specifying products from sustainable sources such as FSC Certified Wood or regionally available from abundant sources. Avoid use of imported or exotic species of woods.

Wood Treatment

Wood used in conjunction with roofing installations and wood which is installed in contact with concrete or masonry shall be pressure treated with an approved preservative to meet AWPS Standards. Other installations shall receive prime coats suitable for finishes specified as soon as installation is complete. Back prime where dampness or warping is anticipated.

Sheathing

The preferable construction for exterior walls is brick with concrete masonry back-up and a gypsum wallboard interior finish material. If the exterior wall is brick with metal stud back-up then the sheathing material shall be Densglass Gold or equal. Gypsum sheathing shall not be used.

Finish Carpentry

Materials and fabrication shall conform to Architectural Woodwork Institute specification for Custom quality work.

Millwork

Materials and fabrication shall conform to Architectural Woodwork Institute “Quality Standards” specification. Use “Custom Grade” for standard millwork and “Premium Grade” for unique and special features.

Architectural Wood Casework

Materials and fabrication shall conform to Architectural Woodwork Institute specification for Premium quality work.
General Information

Building Envelope shall comply with State Energy Code, ASHRAE 90.1-2010.

A method to clean all exterior glazing must be incorporated into the project. Verify method with Facilities Department.

Building Insulation

Maximize insulation value of the building envelope to conserve energy and incorporate an air barrier. Avoid insulation material containing formaldehyde and consider insulations with recycled content.

Non-combustible or FM Approved insulation is recommended in place of foam-based products (polyurethane, polystyrene, etc.), and is especially important in unprotected, concealed spaces, such as attics and crawl spaces, or in hollow-core walls that will be penetrated by electrically-rated equipment.

FM Approved foam insulations for wall/ceiling have been evaluated according to FM Approvals Standard 4880, and are listed at [www.approvalguide.com](http://www.approvalguide.com) under Building Materials/Building Insulation/Foam Insulation.

Roofing

All new roof assemblies and roof recovers should be an FM Approved Roof Assembly, designed in accordance to the applicable FM Data Sheets: 1-28 Wind Design, 1-29 Roof Deck Securement and Above Deck Components, 1-31 Metal Roof Systems, 1-49 Perimeter Flashing, and 1-54 Roof Loads for New Construction. All roof submittals should include the FM RoofNav Roof Assembly Identification Number. Further guidance on Wind Design (FM DS 1-28) and FM Approved Roof Assembly Listings is available at [www.roofnav.com](http://www.roofnav.com).

Roofing system shall be determined by local Facilities Department or as indicated in this Division.

Specify service walkways (minimum 2’0” in width) appropriately located to service all roof top equipment from the roof access.

Carefully detail roof expansion joints and flashing.

Completely detail all parapet walls, caps, coping and scuppers. Top of coping should slope toward roofs.
Detail roof edges sufficiently high to prevent water from spilling over and spotting walls and fascias where roof drains are used.

Provide drips on overhangs, ledges, window stools and coping to prevent discolorations of fascias, soffits and walls.

Ensure that sealants specified are to be used within their limitations. When pre-cast concrete wall panels are used, ensure proper compatibility between the surface sealant and the concrete panel when caulking a joint.

Flashing materials for permanent type buildings to be aluminum, stainless or copper (not galvanized metal).

Slope roof adequately to drain (minimum 1/4”/ft. slope). Design primary roof slopes for new buildings into structural frame and not by roof insulation. Crickets to roof drains may be sloped with insulation. Metal building roofs (minimum 1/4”/ft. slope).

Lightweight concrete insulating fill roof decks will not be used in conjunction with urethane roof system. Lightweight structural concrete is allowed.

**Specific Campus Requirements**

**Texas A&M University**

Building Envelope shall comply with ASHRAE 90.1-2010.

Roof systems for new and existing facilities shall meet International Building Code and NRCA requirements and be selected to meet the specific design requirements of each building considering the following criteria:

- Life Cycle Cost
- Sustainability
- Roof Penetrations
- Roof Traffic to access and repair/maintain roof mounted equipment
- Maintainability of Roof System
- Differential movement
- Historical Requirements
- Visibility from Adjacent Facilities/Aesthetics

Texas A&M University facilities currently use built-up roof systems with Coal-Tar Elastomeric Membrane (CTEM), Sprayed Polyurethane Foam (SPF) Roof Systems and Standing Seam Metal Roofs. Single-ply membrane roof systems are also used and can be specified, but should only be specified for low-traffic roofs with few penetrations. Specified roof systems shall carry a manufacturer’s 20-year warranty.
Design shall minimize roof mounted equipment where possible otherwise the design shall include “passive” fall protection such as parapets and/or guardrails.

**Texas A&M University at Galveston**

Single Ply with FM Global compliant design and uplift tests

**Tarleton State University**

Single Ply – Sarnafil PVC
- Classification: Type II, Grade I, PVC
- Membrane Thickness: 72 mils, +/- 2.0 mils
- Solar Reflective Index (SRI): 104
- Felt Backing: Polyester felt with a weight content of 9 ounces per square yard
- Exposed Face Color: White

Pitched Roofs – GAF/ELK Timberline Shingle (Prestique 30 year)
- Color: Hunter Green

**Prairie View A&M University**

Modified Bitumen

**Texas A&M University-Corpus Christi**

Modified Bitumen

**Texas A&M International University**

Clay Tile and Single Ply

**Texas A&M University-Kingsville**

Clay Tile or Modified Bitumen

The clay tile assembly must be nailed AND mortared with at least 2 nails in the field of the roof, and 3 nails in the perimeter and corners areas. Cement grout should be provided in the space under the tile ribs in the first row along the eave. Miami-Dade County Approved Clay Tile Systems are also acceptable, if capable of withstanding the uplift pressures for the geographical area.

West Texas A&M University

Single Ply - mechanically attached
Pitched Roofs – Standing Metal Seam Deck or Composite Shingles

Texas A&M University-Commerce

Modified Bitumen

Texas A&M University-Texarkana

Fully Adhered TPO Membrane
Guide Specification

Urethane Foam Roof System

1.0 GENERAL

1.1 SUBMITTALS: The following shall be submitted for review by the project architect prior to the start of any contract roof work.

A. Data

Submittals which provide descriptions or documentation regarding the work and descriptive information regarding products, materials, equipment, or components to be used in the work.

B. Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

C. Certificates

Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of the contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements which are being certified.

1.2 SCOPE

A. This section specifies polyurethane foam roof systems.

B. Packaging: Materials are to be received in sealed containers of the approved manufacturer; shipped from the factory with legible manufacturer's labels and underwriters labels thereon where applicable.

C. Batch Date: Age of packaged materials shall be evidenced by the date of batch clearly stamped on the container.

D. All material shall be new and to be applied within six (6) months from time manufactured as evidenced by the batch date.

1.3 WARRANTY
A. **Roofing System**: The Contractor shall provide a manufacturer's written warranty, as specified in paragraph 3.5, covering failure of the Foam Roof System against defects in manufacturing, materials, and/or workmanship. Failure is defined to include, but is not necessarily limited to, defects or deterioration of the system resulting in material discoloration, delamination, peeling, or cracking. Warranty period is ten (10) years after the date of substantial completion.

B. **Guarantee Inspections**: On expiration of the first year and at least every other year thereafter of the guarantee period, the Coating Manufacturer accompanied by the Owner shall inspect the urethane foam and coating system to determine the condition of the roof.

1. Any repairs that are necessary shall be accomplished as stated in the guarantee.

2. The Coating Manufacturer shall submit to the Owner a report stating the results of each inspection as it affects the remaining period of the guarantee.

2.0 **PRODUCTS**

2.1 **GENERAL REQUIREMENTS**


2.1 **SPRAY APPLIED MEMBRANE MATERIALS**

A. **Primers**: As required by Materials Manufacturer for the following items or conditions:

   Non-ferrous metals.
   Ferrous metals.

B. All applications shall be applied with the appropriate mil thicknesses as recommended by the approved manufacturer.

C. **Polyurethane Foam**: Provide 3 PCF Density, two Component System, 1:1 ratio formulated for use on roofs where smooth surface characteristics are desired.
D. **Approved manufacturers:** If it meets the criteria of this specification, the following manufacturers will be acceptable:

- PSI - S245-30 (SS, RS, WS) Bay Systems North America, Spring, Texas
- Elastospray HPS-81302, BASF, Carrollton, Texas
- RT-2031, Resin Technology, Ontario, California

1. Foam manufacturer shall provide manufacturing date of foam components. Foam shall be applied within six months of date of manufacture.

2.2 **SILICONE COATING SYSTEM**

A. Silicone coating shall consist of a two-coat system, fluid applied elastomeric membrane with granules for protection of polyurethane foam.

B. **Approved manufacturers:** If it meets the criteria of this specification, the following manufacturers will be acceptable:

- BASF Elastocoat Silicone 3-5000
- Everest Silicone Coating - Eversil 580
- G.E. Silicone Coating - SCM 3308 Base Coat and SCM 3304 Top Coat
- Neogard RTV Silicone #7850

1. Coating manufacturer shall provide manufacturing date of coating components. Coating shall be applied within six months of date of manufacture.

C. Granules: Shall be #1 grit blasting sand. Color to be selected from manufacturer's standard colors.

2.3 **ACCESSORIES**

A. **Roof Jacks:** As recommended by the roof system manufacturer, high temperature vents shall have insulation sleeve and storm collar. Roof jack construction and installation shall meet requirements of the International Building Code, International Plumbing Code, International Mechanical Code and NFPA 54, National Fuel Gas Code.

3.0 **EXECUTION**

3.1 **SURFACE PREPARATION**

A. Inspect existing roof system and parapet prior to starting any work. Make note and notify Owner of conditions unfavorable to beginning work.

B. All ferrous metal flashing, trim, vent stacks, cants, etc. will be cleaned dust
and grease free prior to priming with specified primer.

C. All non-ferrous metals will be cleaned and chromate etched prior to applying specified primer.

D. No primer will be installed over metals, ferrous or non-ferrous, without a visual inspection by the Owner's representative of all preparation. Failure of inspection may constitute removal of work and work re-attempted until accomplished correctly without any additional cost to the Owner.

3.2 APPLICATION OF SPRAY FOAM

A. Prior to spraying foam the following criteria must be met: Contractor shall give Owner 48 hours notice prior to spraying any material, including primer, foam or coating.

B. The Contractor shall provide all necessary barricades, signs, warning of spray area as determined in the preconstruction conference. The Contractor shall set these signs out the night before spraying begins.

C. The Contractor shall be responsible for the removal of signs and barricades at the completion of the job.

D. The Contractor shall protect any automobile, bicycle, vehicle or other property which is located in a warning area where contact with the Owner has not been made. The Contractor shall secure the property with a polyethylene cover and maintain as necessary during spray operations.

E. The Contractor shall employ approved wind screens for all foam applications. The Contractor is responsible for all overspray and shall have sole liability where damage occurs as a result of this work. Suspend foam spraying when wind speeds exceed 15 miles per hour.

F. Spray foam applicator shall be approved by the materials manufacturer. Spray foam operations shall be performed only during adequate period of calm, open weather, roof surface and ambient temperature above 50 degrees F., winds not exceeding 15 miles per hour. Protect all property from overspray or other damage.

G. Roof surfaces to receive spray foam shall be dry and free of dew or frost. Primer shall be dried free of solvent. One gallon per 100 square feet of surface minimum coverage. Any areas where primer is ponding shall be removed down to existing surface and re-primed with one thin coat of primer.

H. In areas where total tear off of existing built-up roofing is indicated, apply two inches of new urethane foam roof system as needed to ensure positive
drainage.

I. In areas where partial removal of existing foam roofing is indicated, remove one-half inch to one inch of existing foam and apply one of new urethane foam to ensure positive drainage. Spray foam shall be applied in smooth uniform thickness over the entire area except those areas where greater thickness is required for proper drainage, and where other thicknesses are called for on the drawings. Foam shall be coved onto the walls, projections and feathered smoothly into drains, as indicated by the drawings. Grind foam smooth and trough around drains for proper drainage.

J. Low areas, which form puddles, shall be no longer than 18 inches in longest dimension and no deeper than ½ inch. Contractor shall perform a water test 48 hours prior to final inspection, to identify low areas and insure all roof drains are functioning properly.

K. The quantity of spray foam installed per day shall be regulated by the applicator's capacity to apply protective coating during the same day. Any foam left exposed overnight, to include tie-ins, shall be dried and thoroughly primed prior to continuing with the application of new foam or coating.

L. Finished Surfaces: The finished surface texture of the applied spray foam shall be free of excessive ridges, bumps and pinholes, etc. "Popcorn" or "Tree Bark" surfaces as defined by the UFCA coating committee are not acceptable. The finished surface shall be in acceptable condition, without water, dew or excessive moisture prior to application of the specified coating system.

3.3 PROTECTIVE COATING

A. The coating applicator shall be approved by the material manufacturer. Protect all property from overspray or other damage.

B. Protective Coating: Silicone coat shall be applied the same day the foam is applied. **NO EXCEPTIONS ALLOWED!** Coating shall not be applied later than one hour prior to sundown. Any late spraying of coating can only be done with Architect's approval.

C. Equipment: Shall be as required by approved coating manufacturer. Contractor shall submit data on the equipment as specified by the coating manufacturer. Data shall identify, pump ratio, components, pressure ratings and performance criteria.

D. Silicone Coating, Base Coat: Apply to all horizontal surfaces to yield an average of 8 dry mils thickness on horizontal surfaces and 8 dry mils on vertical surfaces. The base coat shall be applied in a single coat using airless spray equipment. Coating to be sprayed using crosshatch method making
sure the entire surface is coated evenly without pinholes, sags or curtains.

**NOTE TO APPLICATOR:** Backroll basecoat to ensure adequate seal of existing surface.

**E. Intermediate Coat:** Apply to all horizontal surfaces to yield an average of 8 dry mils thickness on horizontal surfaces and 8 dry mils on vertical surfaces. Coating to be sprayed using crosshatch method making sure the entire surface is coated evenly without areas of pinholes or sags.

**NOTE TO APPLICATOR:** The above quantities should yield a minimum of 16 dry mils must be achieved prior to top coat and granule application. Upon the satisfaction of proper foam texture requirements, these minimum requirements can be achieved. A wet mil gauge should be used to check thickness. Verify application thicknesses by taking sample slits to ensure minimums. Granules cannot be applied until Owner can verify that the manufacturer's required minimum thicknesses have been achieved.

**F. Silicone Coating, Top Coat:** Apply to all horizontal surfaces to yield an average of 8 dry mils thickness and 8 dry mils of vertical surfaces. Coating to be sprayed using crosshatch method making sure the entire surface is coated evenly without areas of pinholes or sage.

**G. Granules:** Immediately upon completion of topcoat application, granules shall be uniformly broadcast over the wet silicone, at the rate of 50# per 100 square feet, totally covering the entire silicone roof surface.

**H. Details:** Apply an extra heavy coating in each application around all projections, parapet wall, junctions and drains. Coating shall be applied beyond the foam in a double lap coat 4 inches or as far as possible.

**I. Batch Mixing:** Shall be as recommended by the approved coating manufacturer. Contractor shall submit for approval all documentation regarding the proper mixing and batching of elastomeric coating material. Identify procedure, process of mixing, equipment required, components and sequencing solvents required.

### 3.3 INSPECTION

**A.** The Contractor shall maintain a daily project log containing the following information:

1. Temperature and relative humidity at start time, midday and end of day (sling psychrometer permitted)
2. Wind velocity (speed and direction)
3. Sky conditions (overcast, partly cloudy, etc.)
4. Amount of coated foam or coating installed

5. General remarks

A log shall be submitted to the Architect at the end of each day or as directed by project inspector.

B. The Contractor shall flood the roof with water 48 hours prior to final inspection. This procedure shall be coordinated with and in the presence of the Owner. Flooding will provide a means for checking roof drains, low areas and cleaning of roof prior to final inspection.

C. The coating manufacturer shall make an on-site inspection, accompanied by the Owner upon completion of the project. The manufacturer shall submit a report to the Owner stating the final results of the on-site inspection and approval of the application of the materials.

D. The inspection shall include, but not be limited to the following: A slit sample, each 2,000 sf., 2 inches long x ½ inch wide x 3/4 inch deep. Slits shall be closed by the Contractor using an approved silicone caulk. Depth of foam shall be measured adjacent to slit area.

1. Film thickness shall be measured. Overall thickness shall average 24 mils, with top coat of 8 mils.
   Thickness shall not vary over 0.5 mils.

F. The Architect shall periodically inspect the project for compliance with the specification requirements.

3.4 CLEANUP

A. Limited equipment cleanup, such as nozzles, on the roof will be allowed, and only with a suitable nonflammable solvent such as methylene chloride. Major cleaning of equipment shall be confined to the ground.

3.5 GUARANTEE

A. The Contractor shall certify that the foam and coatings were applied in accordance with the manufacturer's recommended procedures. The Contractor shall submit an executed copy of the Guarantee before final payment.

B. The Contractor shall furnish to the Owner a manufacturer's written guarantee, guaranteeing all materials and workmanship for a period not less than ten (10) years from date of final acceptance.

C. The urethane foam and silicone coating system shall be guaranteed against
failures of workmanship and materials. Repair of the system, including materials and labor, shall be at no cost to the Owner.

D. On expiration of the first year of the guarantee, the COATING MANUFACTURER, FOAM MANUFACTURER AND CONTRACTOR accompanied by the Owner, shall inspect the urethane foam and coating system to determine the condition of the roof.

E. Any repairs that are necessary shall be accomplished as stated in the guarantee. Any defects and corrections necessary, but not covered under the guarantee, shall be at the Owner's expense.

2. The coating manufacturer shall submit to the Owner a report stating the results of each inspection for the remaining period of the guarantee.
Guide Specification

Coal-Tar Elastomeric Membrane Multi-Ply Roofing

A. GENERAL

1. REFERENCES – ROOFING
   ASCE-7 – American Society of Civil Engineers: Wind Uplift Requirements
   ASTM – American Society for Testing Materials
   FM – Factory Mutual
   IBC – International Building Code
   IEC – International Energy Code
   NAAMM – National Association of Architectural Metal Manufacturers
   NRCA – National Roofing Contractors Association
   SMACNA – Sheet Metal and Air Conditioning Contractors National

2. DESIGN CRITERIA
   a. Roof slope: New construction minimum 1/4" per foot in any direction; this includes cross-slopes and crickets. Re-roof minimum IBC 1/4" slope not required; zero slope variance.
   b. Crickets: Required to direct water to drains.
   c. Counter flashing: Minimum 8" above roof surface for all rooftop items and equipment.
   d. Equipment curbs: Tops level in all directions.
   e. Primary Roof Drains: Sump for 24" distance around drains (48" distance around drains in less than 1/8" slope in reroofing); caps slotted or screened to minimize foreign object entry. Cast iron drains and caps. All drains to receive lead flashing. All drains installed by local plumbing code.
   f. Walkway Pads: Not used except 6' X 6' area at high and low step-offs at each roof ladder.
   g. Roof Expansion Joints: Roof expansion joints shall be installed according to NRCA guidelines.
   h. Scuttles: Tops sloped to drain.
   i. Copings: Sloped towards roof minimum 1" across width for drainage; Standing seam profile coping.
   j. Insulation: Minimum 2-layer application with all joints staggered minimum 12"; show material types and thicknesses in specifications.
   k. Pipe Penetrations: Braced high and low to structure to prevent movement. Insulate from underside of deck, along laterals, then minimum 6" vertical below next elbow joint (or tangent) to reduce potential condensate drippage.
   l. Existing Roofs: All traffic upon, and work associated with, existing roof systems shall be done in methods, manners, and by personnel endorsed by the manufacturer of the existing roof. The in-effect warranties and
integrity of the existing roof systems shall be fully maintained.

m. Pipe supports: Draw details to illustrate all project conditions.

n. No angle supports through roof plane; if necessary, use capped-off galvanized pipe supports that can be easily flashed and sealed.

o. All flashing shall be mechanically fastened with a termination bar a maximum of 6" on center and be a minimum of eight inches (8") above finished roof height.

p. Vertical wall counter-flashing shall have saw-cut reglet with receiver.

q. All vertical flashing seams shall be hot air welded and become part of manufacturer's twenty (20) year warranty.

r. Roofing system shall be watertight without depending on any metal flashing or coping.

3. MECHANICAL COORDINATION

a. Equipment mounted level; curb types and heights to achieve required minimum base flashing criteria.

b. Gas Equipment heights to achieve minimum 3" vertical clearance between roof surface and bottom of drip leg piping cap.

c. For safety, ease of maintenance, and to minimize damage to roof system components, no equipment locations within 5’ of roof expansion joints and/or roof divider joints, vertical parapets; no equipment within 10’ of roof edges.

d. Roof system thermal insulation values based on heating, ventilation and air conditioning (HVAC) system design and the minimum guideline of IEC.

4. ELECTRICAL COORDINATION

a. New Construction Only: Avoid using pitch pockets for conduit penetrations. Power for rooftop equipment shall be located inside the respective equipment curb and accessible per code criteria.

b. All pitch pockets in reroofing shall be manufactured out of stainless steel, have grout and 2-part sealant. Rain bonnets shall also be installed.

c. Cable TV Masts and Supports: Provide galvanized pipe penetrations, minimum 24" height above roof surface, capped and sealed, anchored high and low to building structure, with base flashing.

5. KITCHEN EQUIPMENT COORDINATION

a. Show all rooftop equipment, penetrations and roof-related details on Drawings.

b. Combine pipe penetrations in hooded enclosures for mechanical piping.

6. STRUCTURAL COORDINATION

a. Top-of-steel elevations to accomplish required slopes and drainage; consider camber on members to avoid trapping water.

b. Footing elevations at wet columns to allow for underground storm pipe slopes/inverts and bends.
c. Supports at roof perimeters, equipment, and roof drain bodies.

7. WARRANTIES
   a. Roofing - Manufacturer: Project shall be installed in such a manner that the roofing material manufacturer will furnish a written twenty (20) year NDL type warranty with no exclusion for hail events containing hail stones up to and including four inches (4") from the date of substantial completion of the completed project. Manufacturer issuing warranty shall provide historical data supporting hail resistance.
   b. Roofing - Contractor: The contractor, jointly with any subcontractors employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the building will be and remain waterproof for a five (5) year warranty period, after the Owner accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the contractor and his subcontractors, if any, to make good the requirements of the warranty.
   c. Warranty repairs shall be performed by a certified installer. The repairs shall be performed in accordance with the manufacturer's written instructions and recommended procedures so as to not void the warranty. Repair of the system, including materials and labor, shall be done at no cost to the Owner.

B. PRODUCTS

1. All materials shall be certified as totally asbestos-free.
   a. ROOF SYSTEMS: 3-ply built-up plus a coal-tar elastomeric finish membrane cap with flood coat and gravel surfacing, complying with UL Class A and ASCE-7 wind uplift criteria.
      1) Finish Membrane: The coal-tar elastomeric membrane (CTEM) shall be minimum 60 mil overall calendared thickness. The membrane shall be a high-performance elastomeric membrane incorporating a DuPont™ Elvaloy KEE (ketone ethylene ester), extended with coal-tar pitch and reinforced with polyester fibers, or approved equal. The coal-tar elastomeric membrane (CTEM) shall meet the following physical properties: Elongation 170%, ASTM D 412; Tensile Strength 1500 lbs/in², ASTM D 412; Tear Strength 330 ppi, ASTM D 624; Density @ 70° F, 80 lbs/ft³; Low Temperature Flexibility, Pass, 37-GP-56M; and Water Absorption less than 0.1%, 37-GP-56M.
      2) Base Flashing: Shall be same material as the coal-tar elastomeric finish membrane (CTEM) and be installed using the design principles set forth in the National Roofing Contractors Association Manual and details included in Specifications.
   b. FELTS: Shall be Underwriters Laboratory approved and listed in the FM Global Approval Guide and shall be Type IV fiberglass ply sheet, Underwriters Laboratory Type G-1, meeting Federal Specification No.
SS-R-620B, ASTM D 2178, Type III, as manufactured by Johns-Manville, or approved equal.

c. FASTENERS: Fasteners and fastening plates or bars shall be listed in the FM Global Approval Guide, and be as recommended by the fastener manufacturer for the specific application.

d. BITUMEN: ASTM D-312, Type IV extra steep asphalt.

e. INSULATION: Shall meet IEC requirements.
   1) First layer: Rigid closed-cell polyisocyanurate; long term thermal resistant R-value, FM Class I fire hazard classification, UL classified for installation with Class A roof covering.
   2) Second layer: Rigid asphalt impregnated on six sides fiberboard, UL classified for installation with Class A roof covering. Provide additional factory-tapered boards (minimum 1/4" per foot slope) for crickets as shown on roof plan.
   3) Insulation requirements can be met using lightweight insulating fill with EPS to meet IEC requirements.

f. EXPANSION JOINTS and DIVIDER JOINTS: Shall be as recommended by NRCA.

g. EQUIPMENT SUPPORTS: As recommended by both the roof system manufacturer and the equipment manufacturer.

h. 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.

C. EXECUTION

1. GENERAL INSTALLATION
   a. Maintain end-of-workday watertight building conditions on all re-roofing projects on existing facilities. Contractor shall be solely responsible for all damage occurring due to failure to properly seal building.
   b. Install only as much roofing insulation as can be covered with roofing during the same work period.
   c. Clean completed roof of all construction debris.
   d. At roofing projects for existing buildings, all debris shall be removed from the grounds at the end of the day.
   e. Test cuts should be performed only where there is reason to suspect that less than proper installation procedures have been used or materials have been shorted.
   f. Copper and aluminum flashings and gravel stops are discouraged due to excessively high cost and possible problems related to vandalism.
   g. IBC requirement of a minimum slope of 1/4" per foot in new construction shall be achieved by sloping the deck and not through tapered insulation. Tapered crickets are, however, encouraged to move water to drains.
h. In reroofing projects, the design standard of 1/4” slope is not required and drainage of roofs shall be accomplished, where needed, with appropriately placed drains and overflow scuppers or gutters and downspouts rather than merely sheet flow to scuppers or over-the-side onto walls.

i. All roof drainage shall be collected in an underground drain system and diverted away from the building. No drainage onto walls from adjacent roof areas shall be permitted except under emergency overflow conditions.

j. All multi-level roofs shall have permanently attached ladders between levels with height differentials of 48 inches or greater.

k. Do not change the design standard and system selected without prior approval.

l. Comply with governing state, and federal regulations, safety standards, and codes.
## APPLICATION FOR ACCEPTANCE OF ROOFING SYSTEM

### CONTACT INFORMATION:

<table>
<thead>
<tr>
<th>ROOFING CONTRACTOR (NAME &amp; ADDRESS)</th>
<th>TELEPHONE NO.:</th>
</tr>
</thead>
<tbody>
<tr>
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<td>FAX:</td>
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<table>
<thead>
<tr>
<th>CLIENT (NAME &amp; ADDRESS)</th>
<th>TELEPHONE NO.:</th>
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<td>CONTACT:</td>
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</tbody>
</table>

### OVERVIEW OF WORK: (Submit 1 form per roof area)

- Building Name & Number:
- Building Dimensions: Length: \(ft/m\); Width: \(ft/m\); Height: \(ft/m\).
- Roof Slope:
- Parapet Height, max (in/m):
- Parapet Height, min (in/m):
- Type of Work:  
  - [ ] New Construction
  - [ ] Recover (New roof over existing Roofing System)
  - [ ] Reroof (New cover/remove existing roofing system to deck)
  - [ ] Other

### FM Approved RoofNav Assembly Numbers:

### ROOF SURFACING:

- [ ] None
- [ ] Coating  
  (Trade Name/Application Rate)
- [ ] Granules  
  (Application Rate)
- [ ] Gravel/Slag  
  (Application Rate)
- [ ] Ballast:  
  - [ ] Stone Size
  - [ ] Pavers  
    (Beveled or square edge)
  - [ ] Other:
- Ballast Weight (psf):  
  - Field:
  - Perimeter:  
    - Corners:

### ROOF COVER/MEMBRANE:

(Provide ALL applicable details including trade name, type, number of plies, thickness, reinforced, adhesive)

- [ ] Panel:  
  - Through Fastened Metal
  - Standing Seam metal
  - Fiber Reinforced Plastic (FRP)
  - Other:
- [ ] Built Up Roofing (BUR)
- [ ] Modified Bitumen
- [ ] Single Ply:  
  - [ ] Adhered
  - [ ] Fastened
  - [ ] Ballasted
- [ ] Spray Applied
- [ ] Other:

### BASE SHEET:

(Please include Trade Name, Type, and Width)

- [ ] None
- Trade Name:  
  Width:  
  - [ ] 36 In.
  - [ ] 1 meter (39 In.)
- [ ] Fastened
- [ ] Secured per RoofNav  
  OR  
  [ ] Per FM Global Loss Prevention Data Sheet 1-29

### Comments:

- [ ] Air Retarder
- [ ] Vapor Retarder

### INSULATION

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<th>Thickness (In.)</th>
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<td>4. Next</td>
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</table>

- [ ] Glass Fiber/Mineral Wool/Batt  
  - [ ] Facer Type/Vapor Barrier
- [ ] Thermal Barrier
- [ ] Other:
- [ ] None
# APPLICATION FOR ACCEPTANCE OF ROOFING SYSTEM

**DECK:**

(Please include manufacturer, type, yield strength, thickness/gage, etc.)

- [ ] Steel
- [ ] LWIC (Form Deck): [ ] Cementitious Wood Fiber:
- [ ] Concrete: [ ] Pre-cast panels or [ ] Cast in Place
- [ ] Wood
- [ ] Fiber Reinforced Cement [ ] Fiber Reinforced Plastic
- [ ] Gypsum: [ ] Plank [ ] Poured
- [ ] Other:

Comments:

**ROOF STRUCTURE (Include Size, Gage, Etc.):**

- [ ] Purlins [ ] “C” OR [ ] “Z”
- [ ] Joists [ ] Wood OR [ ] Steel
- [ ] Beams [ ] Wood OR [ ] Steel
- [ ] Other:

Spacing: Field: _______ Perimeter: _______ Corners: _______

**FASTENERS USED IN ROOF ASSEMBLY:**

**Roof Cover Fasteners:** Trade Name: _______ Length: _______ Diameter: _______

Stress Plate/Batten:

Spacing: Field: _______ Perimeter: _______ Corners: _______

**Insulation Fasteners:** Trade Name: _______ Type: _______

Size: _______

Spacing: Field: _______ Perimeter: _______ Corners: _______

**Deck Or Roof Panels Fasteners:**

Trade Name: _______ Type: _______

Length: _______

If Weld: Size: _______ Weld: _______ Washer: _______

**Deck Side Lap Fasteners:** Field: _______ Perimeter: _______ Corners: _______

Spacing: Field: _______ Perimeter: _______ Corners: _______

**Base Sheet Fasteners**

Trade Name: _______ Type: _______

Head Diameter: _______

Spacing: (Attached Sketches as necessary) _______

Spacing Along Laps: Field: _______ Perimeter: _______ Corners: _______

No. Intermediate Rows: Field: _______ Perimeter: _______ Corners: _______

Spacing Along Intermediate Rows: Field: _______ Perimeter: _______ Corners: _______

**PERIMETER FLASHING:**

(Attach a detailed sketch of metal fascia, gravel stop, nailer, coping, etc.)

- [ ] FM Approved Flashing
- [ ] Per FM Global Loss Prevention Data Sheet 1-49
- [ ] Other: _______

Comments:

**DRAINAGE:**

For new construction: Has roof drainage been designed by a Qualified Engineer per FM Global Loss Prevention Data Sheet 1-54 and the local building code? [ ] Yes [ ] No (Attach details)

For re-roofing and recovering: will the roof drainage be changed from the original design (for example: drain inserts, drains covered or removed, new expansion joints, blocked or reduced scupper size?) [ ] Yes [ ] No

If yes, were the changes reviewed by a Qualified Engineer? [ ] Yes [ ] No (Attach details)

Is secondary (emergency) roof drainage provided per FM Global Data Sheet 1-54? [ ] Yes [ ] No (Attach details)

Signature of Property Owner: ____________________________

Title: ____________________________ Date: ________________

Signature of Installing Contractor: ____________________________

Title: ____________________________ Date: ________________
**APPLICATION FOR ACCEPTANCE OF ROOFING SYSTEM**

**FM Global OFFICE REVIEW**
*(Please leave blank for FM Global Office Review)*

### WIND:

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<th>Ground Terrain:</th>
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### FIRE:

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### HAIL:

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<tr>
<td>Adequate?</td>
<td>Yes</td>
<td>No</td>
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</table>

### COLLAPSE:

- If standing seam, has collapse been reviewed? □ Yes □ No

### COMMENTS:

Reviewed By: 

Date: 

---

**FM Global Field Review:**
*(Leave blank for on-site review by FM Global Loss prevention Consultant):*

System installed per reviewed/accepted plans? □ Yes □ No

If no, explain:

Installation witnessed by FM Global? □ Yes □ No

Uplift test needed? □ Yes □ No

*(Uplift testing is REQUIRED for applicable new and recover roofs in hurricane, typhoon or tropical cyclone prone regions (see DS 1-29 and 1-52 for more information)*

Uplift testing satisfactorily completed □ Yes □ No □ DNA

If yes, note pressures held for the: Field ─ Perimeter ─ Corners ─

If no, explain and provide required and obtained uplift pressures and other details and attach to this form.

Reviewed By: 

Date: 

---

X2688 ENGINEERING (Rev. Feb 2007)
General Information

Building fenestration shall comply with State Energy Code, ASHRAE 90.1-2010, including assembly U values, assembly SHGC and percentage of glass.

Ensure that windows, doors, and louvers are designed for adequate wind loading and velocity pressures per International Building Code and Texas Windstorm requirements as applicable.

All general use building entrances shall have a vestibule. At least one door at primary entrances shall be power operated. Primary entrances shall be designated by the User Coordinator and Facilities Department.

Doors may be sliding or swinging, as appropriate to the building use and design, with safeguards and handicapped accessibility as necessary. One-way or two-way types may be used, depending upon traffic. Door types, materials, hardware, and sensors shall be established designs with proven field experience under similar usage. Consideration shall be given to availability of trained service technicians and spare parts.

One or more entrance doors may require card key access. These entrances shall be selected by the User Coordinator. The door frames shall be prepped as a part of the design and construction of the building. The card key devices shall be acquired by the Campus and delivered to the Contractor for installation or installed by the Facilities Department.

The use of daylighting in the building design is strongly encouraged. Use of skylights is not allowed unless approved in writing by the Facilities Department. Use of protected clerestory glazing is allowed.

Warning bars or cross mullions shall extend across all full height glazed areas. Meet requirements of "Model Safety Glazing Code" and " Consumer Product Safety Commission."

For coastal campuses with 3sec wind gusts > 110 mph (Galveston, Kingsville, Corpus Christi), install Large Missile Impact Resistant Laminated Glass, especially for large openings (>20sq.ft.) where shutters cannot be installed, or over 100% of openings on critical or high-value buildings, or for multistory buildings, install at heights above 60ft.

Ensure the systems are satisfactorily tested per Florida Building Code Testing Application Standards (TAS) 201, 202, and 203, or ASTM Standards E1886 and E1996.

To search for Miami-Dade (Building Code Compliance Office) approved products on the web, see: www.miamidade.gov/buildingcode/psearch_app.asp
Windstorm shutters may also be used to protect windows against flying debris and high inward/outward pressures if they are permanently installed, or can be installed campus-wide within 8hrs of arrival of an approaching storm. Shutters should be capable of withstanding the inward/outward pressures. Miami-Dade Country Approved Products are preferred.

At minimum following information shall be part of the parametric data associated with door frames and doors: room number (automatically assigned), frame material, door material, frame finish, door finish, frame gauge, door gauge, hardware listed individually not by set, fire rating, door swing.

**Doors and Frames**

Exterior and interior personnel doors shall not be taller than 7 feet high unless approved by the Facilities Department.

All entrance doors and frames shall be hinge and strike reinforced for “High Frequency” use.

Hollow Metal Exterior Doors shall be not less than 16 gauge with 14 gauge or heavier one piece welded frame. Door and frame shall be A60 galvanized.

Interior Hollow Metal Doors shall be not less than 18 gauge with 16 gauge one piece welded frame.

Interior wood doors shall be at least 1-3/4” thick to accommodate mortise locks.

Interior wood doors are generally flush type, solid core, hardwood with lifetime warranty. Wood doors can be either wood veneer or plastic laminate faced. Exotic wood veneers are prohibited.

**Entrances, Storefronts and Curtainwalls**

Metal framed glazed entrance assemblies shall have stiles of sufficient width to receive mortise locksets and/or panic hardware. Custom styled doors with vision panels may be used. Locksets shall be at conventional height and shall not be permitted in bottom rails. Bottom rail shall be a minimum of 12 inches and top rail shall be a minimum of 6 inches.

Wherever possible utilize storefront systems instead of curtainwall systems.

Include in specifications, steel reinforcing inserts in the hinge jamb section of doors in aluminum storefront systems.

Color of storefront, curtainwall and window frames shall match the campus standard.
Windows

Heads, jambs, and sills of windows in walls shall be flashed and shall be caulked or sealed during the window installation, prior to the placement of snap-on moldings or covers, to ensure that concealed surfaces are properly sealed against the penetration of wind and water. Flashing shall include pre-molded end dams. All windows should have drips at heads and sills.

Projected and casement type windows, and flush mounted windows are difficult to maintain watertight and their use is discouraged.

Design windows with maintenance in mind and include provisions for cleaning windows above third floor.

Hardware

The hardware schedule shall be included in the project specifications.

A minimum of one pair of exterior double doors shall have a keyed, removable mullion for equipment access.

Use thresholds and weather stripping at exterior doors to prevent air and water infiltration.

Specify all finish hardware. Locksets will be by the manufacturers’ below and for the most part shall be heavy duty mortise type with key removable core cylinders (except at Tarleton). Locksets shall accept interchangeably the cores and cylinders from the manufacturer(s) below

All doors leading into hazardous spaces, mechanical, electrical and telecommunication rooms shall have a textured surface on the door lever.

All doors at wet and high humidity areas such as kitchens, shower rooms, mechanical rooms, etc. shall have a brass or bronze (non-ferrous) base metal hinge or stainless steel hinge.

Contractor shall execute construction core agreement with Locking Systems Supplier prior to shipment of permanent cores.

Satin chrome plated finish is generally used.

Door closer by LCN, Norton or Sargent are acceptable; hinges by McKinney, Hager, Lawrence, or Stanley are acceptable; equal quality hardware of other manufacturers will be acceptable.
Specify plated hinges only for doors receiving a natural or transparent finish; specify prime coated hinges for painted doors.

Specify ball bearing or oilite bearing hinges only on doors which receive closers. Non-removable pin hinges for out swinging exterior doors and other "secured" areas. Specify closers generally for exterior doors, doors in fire-rated walls, and toilet room doors. Special laboratory conditions or other special room function may require use of closers on doors.

All doors having closers should be protected from wear of wheelchairs by a minimum of 10" high kickplates.

Do not specify pivot hinges or concealed closers.

The A/E shall investigate the security requirements for the project and develop an appropriate keying system. The specifications shall call for two (2) keys for each lockset, One (1) control keys along with an appropriate quantity of grandmaster, master and sub-master keys to be provided. A Bitting Schedule and set number of key blanks will also be required. Final keying functions shall be established during a key conference conducted by FPC, with the A/E, User, Facilities Department, Contractor, and successful hardware supplier during construction.

Verify other requirements such as extra key blanks, key box, etc. with User and Facilities Department.

Concealed rods on exit devices are not allowed.

**Glazing**

High performance glazing is strongly encouraged with a tint to match surrounding buildings. Highly reflective (mirror) glass and dark tinted glass are not allowed.

Partial shading of insulating glass can cause stress breakage. Manufacturers consider this to be a design error and will not replace glass broken by temperature differential stresses. Avoid partial shading of large panes.

Provide manufacturer’s written guarantee that for ten years from date of Substantial Completion a replacement will be provided for any insulated glass unit which develops edge separation or other defects which materially obstruct vision through the glass or safety or affects the insulating qualities. Guarantee shall not cover glass breakage from physical abuse, storm or similar causes.
Specific Campus Requirements

Texas A&M University

Building fenestration shall comply with ASHRAE 90.1-2010, including assembly U values, assembly SHGC and percentage of glass.

Hardware

Always verify hardware specification with TAMU Building Access Department

Hinges

All hinges shall be full mortise template five-knuckle, 4-1/2 inches high as manufactured by Hager, McKinney or Stanley. Use Non Removable Pin (NRP) feature on all exterior doors that swing out. Use the proper hinge width as determined by the clearance required.

Exterior doors over 36 inches and all primary entrance/exit doors. Use heavy weight, four bearing, stainless steel hinges with 630 finish.

All other exterior doors. Use standard weight/medium frequency, two bearing stainless steel hinges with 630 finish.

Interior doors over 36 inches, all corridor doors, and doors with closures - Use heavy weight four bearing, steel hinges with 652 finish.

All other interior doors - Use standard weight medium frequency, two bearing steel hinges with 652 finish.

Locksets

Mortise locks shall meet ANSI A256.13 Series 1000, Grade 1 Operational and Grade 2 Security. Listed by Underwriters laboratory for use on 3 Hour A label doors. Lock case and face plate dimensions fit standard door preparation as specified in ANSI A115.1. Locksets and Latch-sets must have the ability to change handling without opening the case. Other requirements are as follows:

Satin stainless steel No. 626 or 630 finish.

One inch stainless steel throw deadbolt.

3/4 inch throw anti-friction latch bolt standard.
Quick re-keying with interchangeable core small format.

Solid lever trim with return.

3 year published limited warranty.

Furnish all locksets with 7-pin interchangeable core cylinders. Acceptable locksets are:
- Best 45H - 15H
- Sargent 8200 –LW1L
- Falcon MA series - DN

**Cylinders**

Cores shall be manufactured by “Medeco Security Locks” and shall be an extension of the existing A2 master key system using interchangeable Medeco x4 EFV cores. Use Medeco interchangeable core cylinder housing 33076021-Z02 with security collar 94-0151 on exterior aluminum doors that have Adams Rite Locksets, 2 year published warranty.

All Medeco keys provided to Texas A&M University, be they factory cut keys or key blanks shall be custom coined with approved Texas A&M logo. Utilize Medeco coining die #D353.

The TAMU Building Access Department will be responsible for changing out the construction cores with the permanent cores and for returning construction cores to building Contractor.

**Exit Devices**

Devices shall be Satin stainless steel finish No. 630. Other requirements are:

Narrow stile exit devices only where the door stile dimension requires.

Use mortise exit devices only where a pair of doors cannot have a removable mullion. Use on the active leaf with a surface mounted device on the inactive leaf.

Five year mechanical warranty and one year electrical warranty.

Device to be equipped with lever. Acceptable exit devices are:

<table>
<thead>
<tr>
<th>Type</th>
<th>Von Duprin</th>
<th>Sargent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rim Mounted</td>
<td>98</td>
<td>8813 ETL</td>
</tr>
<tr>
<td>Rim Mounted, Fire</td>
<td>98F</td>
<td>12-8813 ETL</td>
</tr>
<tr>
<td>Surface, Verticle</td>
<td>9827</td>
<td>8713 ETL</td>
</tr>
<tr>
<td>Surface Vertical, Fire</td>
<td>9827F</td>
<td>12-8713 ETL</td>
</tr>
</tbody>
</table>
Doors where electronic access is required and magnetic locks are going to be used shall include an internal signal switch to break lock power. Only Sargent 88 series or Von Duprin QUE-99 series electric panics are acceptable wherever electric panics are specified.

**Doors Closers**

Door closer will have a heavy duty cast iron cylinder with all-weather hydraulic fluid, 10 year warranty, painted aluminum finish, UL listed for use on fire-rated doors, separate back check, sweep speed, and latch speed regulating valves, fully adjustable. LCN 4040 Series, Sargent 1430, Sargent 1431 (handicapped) are acceptable.

Any substitution or alternates will need to be approved by the campus Facilities Department, Facility Maintenance and Renovation Division. Approval process will begin with FPC Project Manager.

**Tarleton State University**

**Doors**

Hollow Metal Door Frames: Curries or Ceco SU series, unequal rabbit, 16 gauge
Hollow Metal Doors: Curries 607 (light weight, interior) 18 gauge face skin
Curries 747 (heavy weight, exterior and stairwells) 16 gauge face skin and 20 gauge stiffeners
Ceco Door Medallion or Trio (same as Curries)
Wood Doors (solid core): VT Industries 5502 (top and bottom rails 1-3/8”, vertical stiles 1-3/8”
Mashefield Signature Series (plain sliced red oak flush, clear 0-05 finish)
Aluminum Storefront: Special Lite SL-15 Monumental
  ¼” bronze tempered glass (exterior)
  ¼” clear tempered glass (interior)
SL-484 12” FPR Mid-pamel
SL-88 recessed pull
10” bottom

**Hardware**

**Hinges**

<table>
<thead>
<tr>
<th>Mortise</th>
<th>9875</th>
<th>8913 ETL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortise, Fire</td>
<td>9875F</td>
<td>12-8913 ETL</td>
</tr>
<tr>
<td>Removable Mullion</td>
<td>KR4954</td>
<td>980 (Steel)</td>
</tr>
<tr>
<td>Removable Mullion, Fire</td>
<td>KR9954</td>
<td>12-980 (Steel)</td>
</tr>
</tbody>
</table>
Ives
Hager BB1279 or BB1168
McKinney

Use heavy weight hinges for restroom and classroom doors

**Gear Hinge**

McKinney
Select SL24HD

Full mortise, continuous and dark bronze

**Locksets**

Sargent T-Zone Non removable cores

Office: 28-11G05-LL-10B (keyway as specified)
Passage: 28-11G15-LL-10B

**Exit Devices**

Hollow Metal Doors: Sargent 8800 Series
  Cylinder Dogging (16-prefix) when Electric Latch Retraction
  (56-prefix) is not necessary for card reader
  Standard: 16-8813-ETL-TB-(hand)-10B
Aluminum Storefront: Von Duprin
  EL-RXCD99NL-OP x 110NL (with card reader)
  RX
  330 (dummy panic hardware)

No vertical rods (concealed or surface mounted) for Exit Devices on aluminum storefront doors.

**Closers**

LCN 4041 (standard duty) or 4110 (heavy duty) dark bronze
PA Shoe (62PA) required for parallel arm mounting

**Automatic Door Opener**

Power Access 4300 Series, pushbutton CE-635 BSM

**Hardware Accessories**
Kick Plates: Ives, Rockwood, Trimco
Overhead Stop: Glynn Johnson 100 Series (if necessary)
Wall Stops: Ives, Hagar (concave rubber bumper) US10B finish
Door Silencer: Ives SR64 (grey or tan)
Threshold: National Guard Product 896DKB (exterior)
Sweep: National Guard Product 200UDKB
Weather Stripping: National Guard Product 160VDKB vinyl perimeter seal

Prairie View A&M University

Hardware

Best or Falcon removable cores (except Sargent locks on mechanical and equipment rooms)

Texas A&M University at Galveston

Hardware

Sargent removable cores

Texas A&M University - Corpus Christi

Hardware

All primary entrance doors shall be horizontal sliding
Service entry doors and frames shall be fiberglass construction

Hinges

Full mortise template hinges, five-knuckle type, plain bearing except at doors with closers or doors over 40 inches width furnish ball bearing type.

Non-removable pin at exterior doors. Non-ferrous hinges at exterior doors. 630 finish.

Furnish quantity of hinges per door as follows:

Doors up to 90 inches in height - 3 butts. Doors over 90 inches and less than 120 inches in height - 4 butts.
Furnish hinge sizes as follows for 1-3/4 inch doors:
- Up to 3'-0" wide, - 4-1/2 x 4-1/2.
- Over 3'-0" to 3'-4" wide - 5 x 4-1/2.
- Over 3' - 4" wide - extra heavy 5 x 4-1/2.

Width of hinges adjusted as required to clear adjacent to.

Doors over 1-3/4" thick to receive heavy weight.

Hager, Stanley, McKinney, Lawrence or equal.

**Aluminum Geared Hinges**
- Hagar – Roton
- Pemko
- ABH Mfg.
- Select

**Stainless Steel Hinges**
- Hagar – Roton
- Markar
- ABH Mfg.
- Select

**Locksets**

Qualities: Mortise locksets, function as listed on schedule (function identification numbers of BHMA-PS). Backsets and strike types as required by conditions. Furnish with construction key system. All locks to accept Primus interchangeable removable core cylinders.

Standard: ANSI A156.2, Series 4000 Grade 1. 626 Finish.

Source: Schlage D Series Rhodes.

**Exit Devices**

Wood and hollow metal doors: Von Duprin 88 Series with push trim or Sargent 9800 Series.

**Door Closers**

Fully hydraulic, full rack and pinion action high strength cylinder. Furnish complete with forged steel arms, necessary brackets and fasteners. Top of door mounting. Provide parallel arms at exterior doors. Provide hex nuts and bolts on wood doors. Provide necessary brackets and plates for complete working application. Furnish other scheduled accessories. Provide non-handed closers at doors requiring handicapped opening force requirements. Size closers in accordance with manufacturer's directions.

Source: LCN 1460/4040

**Texas A&M International University**

**Hardware**

Best removable cores

**Texas A&M University-Kingsville**

**Hardware**

Best 7 pin removable cores

**West Texas A&M University**

**Hardware**

**Hinges:**

All hinges shall be full mortise template hinges, 5 knuckle type, heavy-duty ball bearings, and 3-4 ½ inch butts per door.

Roton continuous hinges are to be used on all external doors and doors with special application i.e. abnormal weight or high volume usage. Finish on all hinges is to match other hardware on door, and existing surrounding hardware.

Hager Hinge Co. and Stanley Hardware are approved for butt style hinges.

Spring loaded hinges are to be used on approved doorways. PBB World Class Hinges, model number SP81 or other approved manufacturer are to be used.

**Locksets:**

All locksets shall be heavy-duty, Schlage “ND” Rhodes.

All exterior access with hard key shall be interchangeable core design locks.
All hardware installed during a remodel or new construction shall match finish with existing hardware or as so specified in new construction guidelines.

**Cylinders:**

Schlage maintains and expands WTAMUs master key system.

Contractors shall furnish information on cylinders to Schlage i.e. Cylinder design- Rim, Mortise, Key in Lever, etc.

Levels of master keying shall be coordinated through the WTAMU Lock Shop. A copy of the Lock/Key order shall be provided to the Lock Shop prior to the order being sent to Schlage by the contractor.

**Exit Devices:**

All exit devices shall be Arrow S3800 series, Sargent 80 series, or Von Duprin 98/99 series or approved series via the WTAMU Lock Shop.

Any panic device that is keyed access shall use Interchangeable Core (IC) cylinders.

Panic devices that have dogging mechanisms shall use I.C. cylinders.

On double doors that incorporate center mullions: the center mullion shall be key removable with I.C cylinders.

**Electronic Access:**

Any electric strikes shall be H.E.S. 9600 series, 5000 series or a model approved by WTAMU Lock Shop.

NO electrified Locksets will be accepted unless first approved by the Lock Shop. Finish should match surrounding door treatments.

**Closers:**

All door closers shall meet TAS and ADA requirements.

Approved closer: LCN model #4041

Closers shall be installed with H-EDA arms or 3049 EDA arms or other approved arms per application.

**Power Operators:**
Any automatic door opening systems should be a Stanley Magic-Force, Nabco Model 710 Swing Door System or LCN 4630/4640 Electric Auto-Equalizer Series

Any variations shall be approved by the WTAMU Lock Shop

**Texas A&M University - Commerce**

**Hardware**

Locksets: Best or Sargent

Cores: Best

**Texas A&M University-Texarkana**

**Hardware**

Hinges – Full mortise, button tipped, ball bearing. Interior hinges primed for paint, USP. Exterior hinges, satin finished stainless steel, US32D


Hardware accessories – Match lockset finish.
General Information

The preliminary selection of interior finish materials shall take place during the schematic design phase. During the design development phase the A/E’s Interior Designer shall present a minimum of two distinct color schemes to the User Coordinator and FPC Project Manager. A final color scheme will be selected and incorporated into the specifications.

Interior finish materials shall be high quality, durable materials that are easily maintained and manufactured regionally. Particular attention shall be given to finishes in public spaces. The use of materials with recycled content is encouraged.

Avoid the use of imported, costly or high maintenance materials. Finishes or detailing that have minimal tolerances and place unrealistic expectations on the installing contractor(s) shall be avoided.

Verify attic stock quantities of interior finish material with Member Facilities Department.

Gypsum Wallboard

All interior gypsum wallboard should be at least a DensArmor or DensArmor Plus or equal mold resistant wallboard.

All gypsum wallboard, regardless of location, shall be not less than 5/8”.

Tile

The use of ceramic tile is encouraged for high profile/high use public areas, restrooms, shower and locker rooms or other spaces where a durable material is appropriate. Avoid dark colors and extremely light colors for tiles. Avoid white or light colored grout for floor applications.

Consider the use of tile or other durable material as wainscot on high traffic corridor walls especially near classrooms.

All floor tiles shall be non-slip and rated for heavy duty use.

Designs where floor and wall tile indicate a pattern of colors or a “mosaic” shall be detailed in the drawings using specific tile sizes dimensions and notes to clearly indicate the extent and complexity of the pattern or “mosaic”.

All floor tile grout shall be sealed. In frequently wet areas such as showers, floor and wall grout shall be sealed. Grout shall match intended application.
**Suspended Acoustical Ceilings**

All ceilings shall be designed to be easily accessible for maintenance and other access needs. A single type of ceiling tile such as 2 ft x 2 ft or 2 ft x 4 ft, minimum 5/8” thick, non-directional pattern tiles with a recycled content shall be used throughout a building to minimize maintenance and repair costs. Exceptions to this are special areas that are identified in the POR.

Ceiling suspension assemblies shall be supported directly from the building structure and shall be supported at all four corners of fluorescent light fixtures. Location of hangers shall not interfere with access to VAV filters, valves, dampers and other items requiring maintenance.

All ceilings shall be modeled at the assigned height in the BIMs.

Ceiling assembly systems, such as finished gypsum, suspended ceilings, or acoustic ceiling clouds, can require fire protection be provided both above and below, under the following circumstances:

- The open space between the finished ceiling within the normally occupied space and the floor or roof above having concealed combustibles in construction (e.g. attics in apartments or student housing with combustible wooden boards & joist and shingled roof construction)

- If a suspended acoustical ceiling cloud or other ceiling-level installation results in an “obstructed ceiling construction.” The definition of “Obstructed” verses “Unobstructed” are defined as:

  **UNOBSERVED:** A ceiling construction or assembly that allows the flow of hot gases to spread out under the ceiling uniformly from the point of fire origin to the nearest four sprinklers in a timely fashion. Ceiling assemblies that meet this definition include:

  - Ceiling systems that have construction materials that do not protrude downward from the ceiling more than 4 in. (100 mm), or
  - Ceiling systems that have construction materials that protrude downward from the ceiling more than 4 in. (100 mm) but their cross-sectional area is 70% or more open, or
  - Ceiling systems that have construction materials that protrude downward from the ceiling more than 4 in. (100 mm) and are less than 70% open in their cross-sectional area, but the volume created by the ceiling structural assembly does not exceed 100 ft3 (2.8 m3), or
  - The horizontal distance between the construction material protrusions exceeds...
the maximum allowable spacing for the sprinkler being installed.

**OBSTRUCTED:** Ceiling assemblies that do not meet the above definition.

### Terrazzo

Use of terrazzo flooring where high traffic occurs is encouraged.

### Carpet Systems

Refer to Guide Specification at the end of this division.

### Resilient Tile Flooring

Vinyl composition tile shall be 1/8 inch thick with thru pattern or thru-chip construction and meets the requirements of ADA for static coefficient of friction when installed in accordance with manufacturer’s guidelines. Recycled content (post-consumer and post-industrial waste) shall be minimum 10%. Material must meet or exceed 5 year warranty

Rubber flooring is also acceptable.

### Vinyl Wall Covering

The use of vinyl wall covering is discouraged especially on interior surface of exterior walls.

### Painting and Coating

Satin or semi gloss enamel paint shall be used on all surfaces and items normally painted. Flat finish paint is not acceptable. Minimum of two finish coats over a prime coat of a different tint than finish coat.

Manufacturers standard color selection shall be utilized. Avoid the use of deeply saturated colors for walls. The use of lighter colors is recommended since these colors enhance reflectivity and reduce the need for lighting. The selection of zero or low VOC products is required to eliminate problems with off-gassing.

Inside surface of wood cabinet drawers two receive two coats of clear sealer.

Top and bottom edges of wood doors to receive two coats of tinted sealer to aid visual inspection.

Except for prime coats on equipment and piping insulation, specify all field painting
The following colors shall be used for banding of all piping and conduits.

<table>
<thead>
<tr>
<th>Service</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Water, Cold or Hot</td>
<td>Blue</td>
</tr>
<tr>
<td>Chilled, Heating or Condenser Water</td>
<td>Green</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Orange</td>
</tr>
<tr>
<td>Air</td>
<td>White</td>
</tr>
<tr>
<td>Steam and Condensate</td>
<td>Light Gray</td>
</tr>
<tr>
<td>Electric Conduit</td>
<td>Yellow</td>
</tr>
<tr>
<td>Drain Lines</td>
<td>Black</td>
</tr>
<tr>
<td>Fire Water</td>
<td>Red</td>
</tr>
</tbody>
</table>

Each pipe circuit is to be marked by stencil. Stencil shall include flow arrow and identification mark as follows: At wall penetrations, machine or tank connections and at not over 50 feet intervals. Stick-on type or plastic wrap-on markers are not acceptable.

<table>
<thead>
<tr>
<th>Service</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Water Supply</td>
<td>Dom-W-S</td>
</tr>
<tr>
<td>Domestic Hot Water Supply</td>
<td>Dom-HW-S</td>
</tr>
<tr>
<td>Domestic Refrigerated Water Supply</td>
<td>Dom-RW-S</td>
</tr>
<tr>
<td>Chilled Water Supply (Air Cond.)</td>
<td>Ch-W-S</td>
</tr>
<tr>
<td>Chilled Water Return (Air Cond.)</td>
<td>Ch-W-R</td>
</tr>
<tr>
<td>Condenser Water Supply</td>
<td>Cond-W-S</td>
</tr>
<tr>
<td>Condenser Water Return</td>
<td>Cond-W-R</td>
</tr>
<tr>
<td>Heating Water Supply</td>
<td>Ht-W-S</td>
</tr>
<tr>
<td>Heating Water Return</td>
<td>Ht-W-R</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Nat. Gas</td>
</tr>
<tr>
<td>Air (Pressure)</td>
<td>Air-Pressure</td>
</tr>
<tr>
<td>Steam (Pressure)</td>
<td>St-Pressure</td>
</tr>
<tr>
<td>Condensate</td>
<td>Cond</td>
</tr>
<tr>
<td>Electric (Voltage)</td>
<td>Elect-Voltage</td>
</tr>
</tbody>
</table>

**Campus Specific Information**

**Texas A&M University**

**Resilient Tile Flooring**

All resilient tile flooring shall be cleaned and left unsealed by the contractor. The Facilities Department will seal and polish the floors.
Tarleton State University

Acoustical Ceiling

Grid: USG Donn DX (White)
Tile: USG Radar 2’x2’, SLT edge (non-directional) white

Texas A&M University-Corpus Christi

Gypsum Wallboard

All interior wallboard shall be DensArmor Plus or equal.

West Texas A&M University

Campus has Interior Finish Standard that will be supplied.

Painting and Coating

The following colors shall be used for banding of all piping and conduits.

<table>
<thead>
<tr>
<th>Service</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Water</td>
<td>Red, equal to Kelly-Moore 5780-562</td>
</tr>
<tr>
<td>City Water</td>
<td>Dark Green, equal to Kelly-Moore 5780-551</td>
</tr>
<tr>
<td>Domestic Water</td>
<td>Dark Green, equal to Kelly-Moore 5780-551</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>Light Green, equal to Kelly-Moore 5780-565</td>
</tr>
<tr>
<td>Treated Water</td>
<td>Beige, equal to Kelly-Moore Bone-27</td>
</tr>
<tr>
<td>Brine</td>
<td>Beige, equal to Kelly-Moore Bone-27</td>
</tr>
<tr>
<td>Chilled Water</td>
<td>Dark Blue, equal to Kelly-Moore 5780-564</td>
</tr>
<tr>
<td>Condenser Water</td>
<td>Light Blue, equal to Kelly-Moore KM299-M</td>
</tr>
<tr>
<td>Heating Water</td>
<td>Yellow, equal to Kelly-Moore 5780-563</td>
</tr>
<tr>
<td>Utility/Control Air</td>
<td>White, equal to Kelly-Moore 5780-103</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Gray, equal to Kelly-Moore Rust-3086</td>
</tr>
<tr>
<td>Sewer/Drain</td>
<td>Black, equal to Kelly-Moore 5780-568</td>
</tr>
<tr>
<td>Steam</td>
<td>Dark Orange, equal to Kelly-Moore 5780-571</td>
</tr>
<tr>
<td>Condensate Return</td>
<td>Light Orange, equal to Kelly-Moore AC7-Y</td>
</tr>
<tr>
<td>Boiler Feedwater</td>
<td>Yellow, equal to Kelly-Moore 5780-563</td>
</tr>
<tr>
<td>Freon/Refrigerant</td>
<td>Tan, equal to Kelly-Moore 171 Sandpebble</td>
</tr>
<tr>
<td>Vacuum</td>
<td>White, equal to Kelly-Moore 5780-103</td>
</tr>
</tbody>
</table>

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identification mark as follows: At wall penetrations, machine or tank connections and at not over 50 feet intervals. Stick-on type or plastic wrap-on markers are not acceptable.

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</tr>
</thead>
<tbody>
<tr>
<td>City Water</td>
<td>White-City Water</td>
</tr>
<tr>
<td>Domestic Water</td>
<td>White-Dom-W-S</td>
</tr>
<tr>
<td>Domestic Hot Water Supply</td>
<td>White-Dom-H-W-S</td>
</tr>
<tr>
<td>Domestic Hot Water Return</td>
<td>White-Dom-H-W-R</td>
</tr>
<tr>
<td>Treated Water</td>
<td>Black-Treated Water</td>
</tr>
<tr>
<td>Brine</td>
<td>Black-Brine</td>
</tr>
<tr>
<td>Chilled Water Supply</td>
<td>White-Ch-W-S</td>
</tr>
<tr>
<td>Chilled Water Return</td>
<td>White-Ch-W-R</td>
</tr>
<tr>
<td>Condenser Water Supply</td>
<td>White-Cond-W-S</td>
</tr>
<tr>
<td>Condenser Water Return</td>
<td>White-Cond-W-R</td>
</tr>
<tr>
<td>Heating Water Supply</td>
<td>Black-H-W-S</td>
</tr>
<tr>
<td>Heating Water Return</td>
<td>Black-H-W-R</td>
</tr>
<tr>
<td>Utility/Control Air</td>
<td>Black-Air</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Black-Nat Gas</td>
</tr>
<tr>
<td>Sewer/Drain</td>
<td>White-Sewer</td>
</tr>
<tr>
<td>High Pressure Steam</td>
<td>Black 90# Steam</td>
</tr>
<tr>
<td>Low Pressure Steam</td>
<td>Black 15# Steam</td>
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<tr>
<td>Condensate Return</td>
<td>Black-Cond Return</td>
</tr>
<tr>
<td>Boiler Feedwater</td>
<td>Black-Feedwater</td>
</tr>
<tr>
<td>Freon/Refrigerant</td>
<td>Black-Refrig</td>
</tr>
<tr>
<td>Vacuum</td>
<td>Blue-Vac</td>
</tr>
<tr>
<td>Decoupler</td>
<td>Decoupler</td>
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Use the following for letter sizing:

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<th>Outside of Diameter of Pipe or Covering In Inches</th>
<th>Length of Field In Inches</th>
<th>Height of Characters</th>
<th>Width of Principal Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than ¾</td>
<td>Use Tags</td>
<td>--</td>
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</tr>
<tr>
<td>¾ to 1-1/4</td>
<td>8</td>
<td>½</td>
<td>1/8</td>
</tr>
<tr>
<td>1-1/2 to 2</td>
<td>8</td>
<td>¾</td>
<td>3/16</td>
</tr>
<tr>
<td>2-1/2 to 6</td>
<td>12</td>
<td>1-1/4</td>
<td>5/16</td>
</tr>
<tr>
<td>8 to 10</td>
<td>24</td>
<td>2-1/2</td>
<td>5/8</td>
</tr>
<tr>
<td>Over 10</td>
<td>32</td>
<td>3-1/2</td>
<td>7/8</td>
</tr>
</tbody>
</table>
Texas A&M University-Texarkana

Resilient Tile Flooring

All resilient tile flooring shall be finished by Contractor with 5 coats of Johnson Showplace wax.

Gypsum Wallboard

All interior gypsum wallboard shall have a Level 4 finish, topped with light textured finish.
Guide Specification

Carpet Systems

1.0 GENERAL

1.1 SUMMARY

A. The following shall be used as a guide for a minimum carpet specification. Other products with equal or better characteristics or qualities shall be considered.

2.0 PRODUCTS

2.1 CARPET SYSTEMS

A. Modular vinyl backed carpet tile or six foot roll carpet with vinyl back.

B. Manufacturers: Interface, Lees, Mannington, Tandus C&A or acceptable substitute shall meet the following requirements:

1. Construction: Textured or level loop tufted.

2. Face Fiber: 100% Invista Antron Lumena® or Antron® Legacy, Antron Blend. Type 6,6 nylon - continuous filament with anti-soil, anti-stain protection.

3. Pile Height: $>0.117$ and $<0.187$. 

4. Yarn Weight: (varies depending on tuft gauge and pile height).

5. Dye Method: 100% solution dyed or a solution dyed yarn dye blend.

6. Stitches per inch: 12 minimum.

7. Tuft Gauge: 1/13 inch (1/12 inch minimum).

8. Primary Backing: 100% sealant vinyl or non-woven synthetic

9. Secondary Backing: 100% vinyl back or 5/32 inch vinyl closed cell cushion back. Backing shall be fusion bonded to face fiber and primary backing to create an integrated product. Shall pass: Test ASTM 3936 delaminating of secondary back, Test ASTM 1667 with 25% deflection @710 PSI.

11. Electrostatic Propensity: 3.5 KV or Less.

12. Warranty: Lifetime – 20 years, non-prorated warranty against delaminating, edge ravel, zippering, moisture penetration, wear.

C. Performance Characteristics:

1. Flammability:
   c. Flaming Mode: <450 per ASTM E-662 NBS Smoke Density.

2. Static: < 3.5 KV Permanent Conductive Fiber per AATCC-134.


5. U. S. Green Building Council LEED-NC 2.2, Indoor Environmental Quality, EQ Credit 4.3, Low-Emitting Materials, Carpet Systems:
   a. All carpet installed in the building interior shall meet the testing and product requirements of the Carpet and Rug Institute's Green Label Plus Program or for which testing has been done by qualified independent laboratories in accordance with the appropriate requirements.
   b. Any carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute Green Label program.
   c. All carpet adhesive shall meet the requirements of U. S. Green Building Council LEED-NC 2.2, EQ Credit 4.1: VOC limit of 50 g/L.

6. Recycled content: minimum 35%.

7. Recyclable: 100% of all content.

2.2 ACCESSORIES

A. Carpet Adhesive: Releasable, pressure sensitive type adhesive shall be water based and allow for removal without damage to carpet or substrate and leave no residue.

B. Adhesive Seam Sealer: (For 6 foot roll goods) As required, provide adhesive seam sealer certified in writing by the manufacturer as compatible with carpet backing. Seam sealer shall have minimum five year manufacturer’s guarantee. Sealer shall create a 100% chemical weld at the seam site to provide a monolithic installation with a moisture barrier.

C. Carpet Edge Guard: Shall be either aluminum or vinyl edge guard or transition in color suitable for a particular installation. Edge guard attachment shall be by mechanical fasteners or glued down.
D. Tread Edge Strip: Shall be rubber or transition in color suitable for a particular installation.

3.0 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. All existing carpet and existing carpet waste shall be reused or recycled in an “environmentally friendly” manner. “Environmentally friendly” carpet recycling methods shall be performed subsequent to job completion. As used herein, “environmentally friendly” methods consist of the following:

1. Repurposing – reusing the product in another application such as facilitating the donation of used carpeting to a charity or other nonprofit organization.


B. Description of Reclamation Services – Carpet must be removed from the existing installation and prepared for pickup based on the type of material and reclamation option selected. Specifications for removal from the jobsite include:

1. Removal of carpet tile and 6 foot roll carpet for repurposing or recycling
   a. Carpet material shall be palletized and secured for shipping, (i.e., shrink wrap, banding, strapping).
   b. Carpet shall be kept dry and free of any moisture damage.
   c. Carpet shall be clean of any non-carpet debris.
   d. Provide a certificate upon request verifying the reclamation of the carpet material.

3.2 INSTALLATION CONDITIONS

A. All sub floors shall be level, clean, dry, and free of dust, dirt, wax, paint, grease, cut back adhesive or any material that might interfere with the overall bond strength of the adhesive. Concrete floors shall be fully cured and free of excessive moisture and alkalinity. No condensation within 48 hours on underside of a four foot by four foot polyethylene sheet, fully taped at perimeter to substrate. Conduct moisture test maximum allowable amount of moisture emitted from floor shall be 3.0 pounds per 1,000 square feet in a 24 hour period.

B. Store carpet and adhesive at a temperature of 70 degrees Fahrenheit for 48 hours prior to installation and maintain for 48 hours during and after completion.
C. Do not expose adhesive to ultraviolet light. Adhesive may be photosensitive and lose its tack.

D. For 6 foot roll carpet cut edges tight to form seams, without gaps, using carpet manufacturer’s recommended seam sealer.

E. When carpet is scheduled for installation on risers and treads, as in auditoriums, and the carpet project as specified with a vinyl cushion back will not install properly over risers and treads, the installer of the carpet project shall be required to provide and install rubber tread edge strips along the front edge of all treads including treads located within the seating areas.

Installer shall have at least five years of experience and be certified by the manufacturer of the carpet submitted.
General Information

Directories

Each building shall have at least one primary directory located in the main entrance of the building. Secondary directories on each floor may be required depending on the complexity of the building. Verify with User and Facilities Department.

Graphics

Interior graphics shall be designed, shown and specified by the A/E and their placement in accordance with Texas Accessibility Standards. Use positive secure method to anchor graphics (tamper-proof screws or toggle bolts not double face tape or epoxy cement). Interior letters shall be Helvetica medium upper and lower case. Graphics for offices shall have area for changeable names.

All building utility spaces shall include the name of the space as well as room number on door graphics. Room numbering shall be approved by Facilities Department at Design Development approval.

Exterior graphics such as signs (except "Handicapped Parking" and traffic signs) and building letters will normally be furnished and installed by the Owner. During design the Project A/E will suggest locations on the building elevations for building name. Exterior letters are generally cast aluminum with mill finish or bronze satin duranodic finish, Helvetica medium font with both upper and lower case letters.

Traffic control signs shall be heat/vacuum baked process using 0.080 gauge aluminum blank sign face of Engineer grade reflectorized sheeting conforming to specification requirements of the Federal and State Manuals on Uniform Traffic Control Devices.

Building Dedication Plaque

Bronze building dedication plaque shall be provided by contractor using approved wording.

Toilet Partitions

Partitions or stalls should be floor mounted and constructed of solid plastic or stainless steel in all permanent buildings unless other materials are approved by the Owner. Provide coat hook and bumper guard on back of each toilet partition door. Coordinate the location of toilet partitions and floor drains.
Corner Guards and Rails

Provide corner guards on corners of corridor walls with heavy pedestrian traffic.

Provide wall guard rails along corridor walls in laboratory areas to protect walls from lab carts.

Toilet Accessories

Provide toilet accessories as required by each Campus.

Fire Extinguishers and Cabinets

Fire extinguishers and recessed or semi-recessed cabinets shall be incorporated into the design as required by code. Fire extinguisher cabinets shall be uniformly sized in building or campus.

Fire extinguishers selection and installation shall conform to the requirements of NFPA 10 *Standard for Portable Fire Extinguishers* or other codes as applicable. Fire Extinguisher shall be new extinguishers and be installed within one year of the manufacture date.

Specific Campus Information

Texas A&M University

Rest Room Requirements

Paper Towel Dispensers

Georgia-Pacific Mfg# HDS200B Cormatic Series towel dispenser
Georgia-Pacific Mfg# 59466 enMotion Touchless SS Towel Dispenser

Stainless Steel Paper Towel Receptacles

Georgia-Pacific Mfg# 59491 Stainless Steel Trash Receptacle
American Specialties Incorporated Mfg#04692 with OM22 filler panel
American Specialties Incorporated Mfg#04692-6 with OM22 filler panel
American Specialties Incorporated Mfg#04692-9 with OM22 filler panel

Water Closet Tissue Dispenser

Georgia-Pacific Mfg# 56790 Compact Vertical Double Roll Coreless Dispenser
Georgia-Pacific Mfg# 56784 Compact side-by-side Roll Bathroom Dispenser
Soap Dispensers

GOJO Mfg# 2730-12 Black Touch Free Foaming Soap Dispenser

Fire Extinguishers

Fire extinguishers selection and installation shall conform to the requirements of NFPA 10 *Standard for Portable Fire Extinguishers* or other codes as applicable. Fire Extinguisher shall be new extinguishers and be installed within one year of the manufacture date. Extinguishers shall be of the followings:

- 5#CO₂ Amerex Model #315 or equal
- 10#CO₂ Amerex Mode #330 or equal
- 10#ABC Amerex Model #419 or equal
- 20#ABC Amerex Model #423 or equal
- Class D Amerex Model #570 or equal
- Class K Amerex Model $B260 or equal

Tarleton State University

Toilet Partitions

Comtec Industries (Scranton Products) Zero Sight Line Compartments
- One inch thick high-density polyethylene resins panels and pilasters
- Rounded radius edges on panels and pilasters
- Panels 55” high mounted 14” above finish floor
- Pilasters 82” high fastened into 3” high stainless steel or plastic pilaster shoe
- Heavy duty 8” aluminum hinges
- Heavy duty 6” aluminum door strike
- Heavy duty aluminum latch and housing
- Door with coat hook/bumper and pull
- Wall brackets 54” long aluminum or extruded plastic
- Headrail heavy duty aluminum
- Headrail brackets 20 gauge stainless steel

Rest Room Requirements

- Towel dispensers: Kimberly-Clark (Scott) 9719 or 9707
- Toilet Tissue Kimberly-Clark (Scott) 9796
- Soap Dispenser Kimberly-Clark (Scott) 91101, 91102, or 91501
- Trash Receptacles Kimberly-Clark (Scott) 9054
Fire Extinguisher Cabinets

Larson #2409-5R with Vertical Duo style door, clear acrylic door glazing, 1½” square trim semi-recessed trim protection and bronze anodized aluminum.

Texas A&M University-Corpus Christi

Rest Room Requirements

Paper Towel Dispensers and Waste Receptacles

James River - Series 2000
James River - Max 2000

Water Closet Tissue Dispenser

James River - RollMaster

Soap Dispensers

James River - Carex Lotion Soaps

Texas A&M University-Kingsville

Rest Room Requirements

Paper Towel Dispensers and Waste Receptacles

Bobrick #B-39003 Dispenses C-fold, multifold and single fold. Surface mount, stainless steel

Bobrick #B-390039 Same as above but with stainless steel skirt for surface mounting

Paper Towel Dispenser (Replacement)

Continental Mfg.Co. #630C Stainless Steel, Singlefold only

Water Closet Tissue Dispenser (Enclosed Box Type for Renovations)

Bobrick #B-3888 Contura Multi-roll with plated steel dispensing mechanism for recessed areas
Bobrick #B-2888 Contura Multi-roll with plated steel dispensing mechanism for surface mount areas

**Water Closet Tissue Dispenser (Replacement Single open roll type)**

Palmer Fixture Company #TP-202 Single Holder Hinged roller pin, security roller, non-controlled delivery, surface mount. Mount two single fixtures per stall

Bobrick #B-2730 Removable, security pin, non controlled delivery. Mount two single fixtures per stall

**Water Closet Tissue Dispenser (Residence Halls)**

Royce Rolls Ringer Company Surface mount  
3 Roll #TP-3 Order Master Lock #TP-Lock or  
4 Roll #TP-4 Order Master Lock #TP-Lock

**Soap Dispensers**

Plastic hand soap dispensers with mounting holes. The dispensers will receive prepackaged 800 ml liquid soap cartons and may take 1000 ml cartons  
  Johnson Soft Care Elite System  
  DermaCare Hand Care

**West Texas A&M University**

**Rest Room Requirements**

**Paper Towel Dispensers and Receptacles**

Towel Disposal Units Georgia Pacific brand, model 59462 smoke color, which uses an 89460 towel.

**Water Closet Tissue Dispenser**

Bay West Model 722, Smoke Grey in color. Two-roll (2) vertical tissue locked enclosed cabinet

**Soap Dispenser**

DEB/SBS Pro line 1-litre White Dispenser, custom printed with the WT logo
Sanitary Napkin Disposal Unit

Lagasse floor receptacle. White enamel finish, galvanized inner liners 9” W x 9” D x 11 ½” H. Serves two stalls with two spring-closing push doors on full length piano hinges.

Mop & Broom Rack (Located in janitor's closets)

ASI Model 8215-4 20 gauge type 304 stainless steel satin finish 4” x 36” long with 4 rubber can holders ribbed for grasping.

Fire Extinguishers

Kidde 5 lb., dry chemical extinguisher with hose. Canister meets DOT requirements and can be hydrostatic tested.

Texas A&M University-Commerce

Rest Room Requirements

Paper Towel Dispensers and Waste Receptacles

Kimberly Clark Model 09994

Water Closet Tissue Dispenser

Kimberly Clark Model 09606
Guide Specification

Cast Bronze Dedicatory Building Plaques

PART 1 - GENERAL

1.1 SECTION INCLUDES:

1.2 Description
1.3 Submittals
1.4 Delivery, Storage and Handling
1.5 Job Conditions

2.1 Products

1.2 DESCRIPTION:

A. Work included: Furnish and install one (1) cast bronze plaque.

1.3 SUBMITTALS:

A. General Contractor will provide a request to the FPC project manager to initiate the plaque wording approval process.

B. FPC will provide a final detailed layout drawing of the plaque to be used for procurement.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver plaque crated to provide protection during transit and job storage.

B. Inspect plaque upon delivery for damage and correctness.

C. Store plaque where it is not exposed to the elements.

1.5 JOB CONDITIONS

A. Coordinate installation with work of other trades.

PART 2 - PRODUCTS

2.1 CAST BRONZE PLAQUES

A. Plaques shall be manufactured by Time Works Unlimited, Inc., P.O. Box 9052, College Station, Texas 77842-9052, (http://timeworksunl.com/), or approved equal. Tablet is to be cast of virgin ingots (85-5-5-5 standard U.S.
Bronze Alloy). Casting shall be free of pits, porosity, imperfections and gas holes and all letters shall be sharp and hand tooled. The backs shall be flat and true. Border and faces of raised letters are to be a satin finish. Background shall be leatherette. Coat compound to ensure plaques will not bleed and discolor the mounting surface. Tap backs of plaques and provide bronze or stainless steel studs for blind fastening.

B. Estimates may be obtained using the template provided.
General Information

Audio-Visual Equipment

Projection screens, where required by the Program of Requirements, shall be motorized and controlled by a non-keyed switch.

Audio visual equipment will may be purchased and installed under a separate contract. The design team must however identify this future equipment and provide a secure location to house it if requested by System Member.

In area where an assisted listening device is required or where sound reinforcement is required by the POR then a complete sound system shall be provided in the project.

Laboratory Equipment

Laboratory Fume Hoods

The following are minimum design specifications for laboratory fume hoods and associated exhaust systems for A&M System projects except as modified with the approval of the System Member Director of Environmental Health and Safety.

1. All laboratory hoods shall meet the requirements of the National Fire Codes, NFPA 45, “Fire Protection for Laboratories Using Chemicals.” Hoods handling radioactive material shall also meet the requirements of NFPA 801, “Recommended Fire Protection Practice for Facilities Handling Radioactive Materials.” Fume hood systems shall also meet the requirements of the current ANSI Z9.5 Standard/ASHRAE 110 TEST. If the requirements below conflict with those of the most recent versions of these national standards, the national standards shall prevail.

Fume hood testing and certification shall be done by the fume hood manufacturer by an independent certifying firm and be done after the installation of the fume hood.

2. Hood design will incorporate airfoil jamb and airfoil sill to reduce airflow turbulence.

3. A variable volume or constant volume hood system design is preferred, depending upon the HVAC system design. For constant air volume hoods, bypass or balanced air feature should be considered to provide an inlet for air to
be drawn into the top of the hood as the sash is lowered, still maintaining the velocity through the face opening at 100 FPM. Hoods will be an integral part of the HVAC system.

4. Auxiliary Air Make-up Hoods with make-up air externally supplied above and on the outside of the hood face are not permitted.

5. Utility valves and switches shall be external, and shall be in conformance with applicable codes and standards. All service valves shall be easily accessible for maintenance personnel and clearly marked. Fixture outlets inside the hood shall be corrosion resistant or have a corrosion resistant finish.

6. Hood lighting shall be vapor or explosion proof, depending upon the intended purpose of the hood. Hood design should be such that light bulbs are changeable from the outside of the hood.

7. The hood sash shall be transparent, easily removable, horizontal sliding or vertical rising panel that will close off the hood face. All parts and counterbalance mechanism shall be of corrosion-resistant material and finish. The sash panel shall be safety glass or plastic that has a flammability rating of 25 or less.

Fume hoods with vertical sashes shall have stops at 18 inches. Whenever the sash is beyond 18 inches a visual alarm shall be activated.

8. Hood construction materials should be selected with regard to the requirements of hood use. Examples of material used include stainless steel and epoxy coated material.

9. Face Velocity Requirements:

Hood selection is greatly influenced by the type of experiments to be conducted within the hood. It is important to establish the maximum degree of hazard anticipated for present and future use before the choice of a hood is made. National standards recognize that the acceptable face velocity requirement for toxic materials used in research laboratories is an average face velocity of 100 fpm with the hood sash fully open (100%) and a minimum at any point of 80 fpm. These performance parameters are to be met. Fume hood testing shall be accordance with ANSI/ASHRAE 110.
10. Airflow Measuring Device:

An airflow measuring device shall be permanently installed on each fume hood. The device shall continuously monitor airflow face velocity, shall give a digital readout of face velocity, and shall sound an alarm for low-flow conditions or whenever the face velocity drops below 80fpm.

11. Exhaust Duct:

Fume hoods may be designed with either an independent exhaust duct system or a manifold system.

A high transport velocity of at least 2000 fpm is needed so that dust and aerosol-size materials are not deposited in the joints, cracks, or corners in the duct system. Normally all exhaust ducts will be constructed of Type 316L Stainless Steel, except where hydrofluoric acid or fluorides in general are used, with all TIG welded or mechanically fastened joints sealed with mineral impregnated woven fiber taper which is further impregnated with an activator/adhesive of the polyvinyl acetate type as manufactured by Hardcast, Inc. or equal. Ducts should be routed vertically with a minimum number of turns. Alternate duct materials will be considered in some applications.

Perchloric acid hoods shall have a completely welded exhaust duct system. Duct shall be routed by the shortest and straightest path to the roof. Horizontal runs are not permitted in Perchloric acid hoods. When required for construction, and approved by the Owner, flange joints and acid resistant gaskets may be used. Do not manifold perchloric hoods.

Perchloric acid hood exhaust outlets shall be flanged and furnished with a companion flange for welding to the exhaust duct.

12. Hood exhaust system design should provide for 10% minimum flow through exhaust duct when hood is not in service. The hood exhaust may be used as part or all of the required exhaust from the laboratory room.

13. Exhaust fans are to be located to the exterior of the building envelope and the pressure in the duct shall always be negative relative to the building.

14. Fume Hood Location:

No fume hood should be installed closer than 10 feet to the primary room entrance/exit door. Fume hoods should also not be installed near expected high
traffic areas within the laboratory or where supply air grills can cause turbulence at the hood face.

Suggested Fume Hood Manufacturers:

Kewaunee Scientific Equipment Corporation
Statesville, North Carolina 28677
704/873-7202

Hamilton Industries
Two Rivers, Wisconsin 54241
414/793-1121

Advanced Lab Concepts
Houston, Texas 77284
281/859-5496

15. Special Hoods:

Perchloric:
Perchloric acid hoods require a “wash down” feature in which water spray is used to remove acid crystals from the exhaust fan, ductwork, and hood plenum after each use. The water must not splash or fall on the work surface. Only one manual valve will control the wash down water. The valve handle shall be outside of the hood enclosure.

Each perchloric hood shall have an automatic five minute wash down cycle activated when the fume hood fan is de-energized.

Radioisotope:
Requires special construction to permit easy cleaning. Filtration requirements of the exhaust air and fume hood construction shall be determined on a case by case basis in consultation with the System Member Environmental Health and Safety Department’s Radiological Safety Officer.

Biological:
Biological Hoods shall meet NIH 03-112C Performance Specifications and shall be in accordance with National Sanitation Foundation Standard, NSF 49, and be listed by NSF. For application guidelines and filtration requirements use HHS Publication No. (CDC) 93-8395, “Biosafety in Microbiological and Biomedical Laboratories.”
Units shall be of steel or stainless steel construction; interior shall be stainless steel with coved corners. All seams and welds to be ground smooth and polished. Sliding view window shall be ¼” safety or tempered glass. Supply and exhaust HEPA filters shall be front loading and shall be 99.99% efficient for 0.3 micron sized particles. Unit shall be listed by UL and CSA for electrical safety. Unit shall include at least one petcock and one duplex outlet; additional services to be provided by user request. Unit shall include a fluorescent light and an ultraviolet (germicidal) light. Certification of unit after installation is required and must be performed by an approved certification company.

Suggested Biological Safety Cabinet Manufacturers:

NuAire Inc.
BioMedical Solutions, Inc.
281/240-5893

The Baker Company
Scientific Resources Southwest, Inc.
888/980-2845

Thermo Forma 800/848-3080

Campus Specific Information

Texas A&M University

Special Hoods

A list of approved certification companies is available from the Environmental Health and Safety Department.

Safety Showers

Floor drains are required beneath all safety showers.

Audio Visual Equipment

Audio/Video for Registrar-controlled Classrooms

Audio Video Requirements

All modifications shall be approved by the Director of Instructional Media
Services (IMS) to comply with standard requirements.

- Audio/Video Designer should work with Instructional Media Services on registrar-controlled room requirements.
- Please contact Director of Instructional Media Services for further details on IMS standard.

AV Closet Requirements

- Buildings with an Audio/Video closet should have a 45-space rack unit such as the Middle Atlantic BGR-45SA-27 or equivalent per room. For example, if one closet corresponds to three (3) rooms, then the closet should contain three (3) rack units.
- Four (4) 120V 20A outlets should be located at the base of each rack unit.
- Two (2) data lines shall be dropped to each rack unit.
- Two (1.5") conduits should run from the lectern floor box (if present) or wall to the AV closet per room. Two additional (1.5") conduits should run from the lectern floor box (if present) or wall to the projector’s location. Please see graphic below for one (1) room example.

![Diagram of AV Closet Requirements]

Room Requirements

- Room shall be controlled via AMX controller, video switcher, digital video transmitter/receiver pairs, and a touch panel interface with built in VOIP intercom.
- Controller and switcher will be an all-in-one unit or equivalent.
- Video switcher should have capabilities for scaling, digital inputs/outputs, analog inputs/outputs, and should be HDCP compliant. Switcher should have additional audio/video ports for expandability.
- A Smart Podium/LCD is required.
- Listen Assistive Listening FM ADA standard system is required for all rooms.
- Lecterns will be the Instructional Media Services Eurodesign standard. Lectern model #s are as follows: MPD2644EA-TX11-R, MPD2644EA-TX11-L, MPD3048EA-TX11-R, MPD3048EA-TX11-L. Room should receive proper model # as specified by Instructional Media Services. Please contact the Director of Instructional Media Services for any questions.

Programming Requirements

Programming shall resemble IMS standard and include AMX Resource Management Suite software links/hooks.

Mounted Equipment requirements

- Chief CMA 440 Lightweight Above Tile Suspended Ceiling Kit.
- Electric non-tab tensioned Projection Screen with build in Low Voltage Controller of adequate size for the room in a 16:10 Aspect Ratio.

Audio Requirements

Audio speakers

In smaller rooms, where small speakers will suffice, four (4) ceiling mount JBL 16Ω speakers need to be installed, for larger applications, a more specific speaker JBL AC 18/26 speakers or equivalent will need to be specified. Large auditoriums will be wired with front mounted speakers in stereo format with ceiling speakers to fill audio voids in room.

Audio Wire Runs

- Small/ceiling speakers will require a 14 gauge plenum-rated cable from Liberty cable (14-2C-P-WHT) or equivalent.
- Larger/front mounted speakers will require a 12 gauge plenum-rated cable (12-2C-P-WHT) from Liberty cable or equivalent.

Audio Mixer

- An audio presentation mixer should be present. Preferably a Nexia PM.

Video Requirements

- Video signals in room should be in digital format.
- Video to projector will be transmitted via four (4) Category 6 cables from Liberty cable (24-4P-L6SH-WHT) or equivalent. Wires will not be
terminated or hooked up to a network switch. These cable runs go from lectern floor box/wall to projector.

Conduit Needs (No AV Closet Present)

- If a floor box is present, two (2) 1.5” inch conduit runs shall connect to the floor box.
  - One conduit run will terminate in the ceiling to an empty double-gang electrical junction box.
  - One conduit run will terminate at the projector ceiling plate to allow Video cabling to be run inside.
- If a floor box is not present, two (2) 1.5” inch conduit runs shall connect to the wall closest to podium location and terminate into a a double-gang electrical wall junction box.
  - One conduit run will terminate in the ceiling to an empty double-gang electrical junction box.
  - One conduit run will terminate at the projector ceiling plate to allow Video cabling to be run inside.

Power Receptacles requirements

- All receptacles specified should be 120V 20A.
- Projector
  - 2 total outlets/projector attached to projector ceiling plate flush visible below ceiling tile.
- Lectern
  - A total of four (4) receptacles are needed in floor box. If floor box is not present, receptacles should be located as close as possible to podium location to reduce the need for floor tracking.
  - Floor boxes should be ADA specified distance from wall where projection screen is located.
- Camera
  - 2 Power receptacles installed flush with ceiling located at back of room located within 6 inches of camera network ports.

Network Connection using Category 6 cable Requirements

- Three network connections ran to Lectern Location.
  - If located in floor box, network cable shall be terminated at floor box.
  - One (1) of the connections will have a network switch installed on it to split the connection for the Lectern Equipment
  - The remaining two (2) connections will be used for other specified equipment.
● One (1) network connection/drop located at the back of the room for security camera.

The camera location will vary depending on the entrance to the classroom, equipment location, as well as structural limitations such as support posts, etc. Ideal location should have a clear view of projector, lectern, projection screen and entry door. If room has two entrances location of camera should be centered in the back of the room.

Audio Visual Surveillance

Audio video surveillance technology (AVST) includes all types of cameras and/or receiving audio devices placed internally or externally throughout campus and the related equipment to operate the cameras/audio or view, listen, and record images and/or audio. All uses/placement of AVST equipment must be reviewed and approved by the AVST Committee (excluding the following):

- authorized broadcast media related;
- used for communication/meetings;
- academic/instructional; or
- investigatory (managed by law enforcement officers or official auditors).

AVST equipment used for surveillance may be monitored or non-monitored.

Camera Operation and Location

All new installations or relocation of surveillance cameras and related equipment must be approved prior to installation by the Audio Video Surveillance Technology Committee as authorized by university Standard Administrative Procedures.

Surveillance cameras may be installed in such areas as the following:

a. Those containing such security systems as the following:
   1. Access control systems, which monitor and record restricted-access transactions at entrances to buildings and other areas
   2. Security alarms, including intrusion alarms, exit-door controls, hold-up alarms, cashier locations, etc.

b. Those containing sensitive institutional data or technology operations

c. Sections of the university campus and buildings that are high-traffic, such as shopping areas, perimeters, unrestricted entrances, exits, lobbies, corridors, and receiving docks

d. Those housing sensitive operations, such as storage areas for special materials, laboratories, select agents, etc.

e. Those containing rare, high-value, or merchandise property, such as the University Library Rare Book Collections and the University Store

Cameras intended for monitoring or displaying general access to public events must be approved in advance and privacy concerns must be specifically addressed by the
Surveillance cameras must not be located in or monitor a campus housing resident’s room or restroom/shower area, or any other restroom/shower area where there is a reasonable expectation of privacy. These types of facilities are used by individuals with a reasonable expectation of privacy and should not be monitored or recorded by a surveillance camera.

**Appropriate and Inappropriate AVST Use**

Surveillance camera use is considered **appropriate** when it enhances:
- The protection of equipment, facilities, and individuals
- The protection of sensitive institutional data or technology operations
- Instruction or research in the classroom or lab
- The monitoring of building entrances and exits

Surveillance camera use is considered **inappropriate** when it entails:
- Infringement on a person’s reasonable expectations of privacy
- Monitoring of personnel related issues or performance not involving safety
- Monitoring of student performance for academic dishonesty
- Installation of a “dummy” camera for appearance sake

**Signage For AVST Equipment**

Conspicuous, public signage must be displayed at all main entrances of buildings and facilities with AVST equipment or in the immediate area of the equipment. Surveillance cameras in some locations may be actively monitored in real time by authorized personnel, whether sporadic or continuously, while other camera locations may not be monitored at all. Departments must clearly indicate in their posted signage if their AVST equipment is not monitored. Signage of the approved size and with approved language is available from the Texas A&M University Facilities Services, Graphics Shop as follows:

“This area is subject to surveillance for security purposes and may or may not be monitored.”

**Requests for Installation of Equipment**

All new installations and relocations of AVST equipment must be submitted through the AVST Committee for review and recommendation according to SAP 29.01.99.M1.28. Notification must be submitted to the AVST committee if a department removes previously installed AVST equipment. The committee reviews requests for appropriate use and location, adherence to university guidelines, and appropriate administration of AVST equipment and data. The committee’s recommendations are submitted to the Vice President and Associate Provost for Information Technology for final determination of the request.

Approval of installation and relocation requests will be guided by the need for security of state property, facilities and people, with attention given to the privacy of members of the university community.
The online installation request form and instructions, and the confidentiality statement, are available at http://nis.tamu.edu/Home/Risk_Management/Audiovisual_Surveillance.php and can be submitted by email to avst@tamu.edu. The individual listed as the primary contact will be notified by email for more information before responding to the request or giving approval to proceed with the installation. The request form must be signed by the dean/department head/director or documented designee.

The approval process may take several weeks to complete depending upon the details of the request and supporting materials, or concerns by the committee. Requesting departments should build into their installation timelines sufficient time for the AVST committee to submit recommendations to the Vice President and Associate Provost for Information Technology for final determination of the request.
General Information

Window Treatments

Window blinds and shades are considered to have a significant impact on the HVAC and Lighting systems in a building. Automatic and/or manual window blinds and shades shall be provided wherever practicable to support and enhance energy efficiency of building systems.

Horizontal 1” mini-blinds shall be included in the design for all spaces.

In spaces where more light control is required “Mecho Shades” or equal are acceptable.

Laboratory Casework

Laboratory casework shall be high quality wood or steel construction unless other materials are appropriate due to space requirements.

Materials for laboratory tops shall be based on intended use.

Verify casework requirements and layouts for accessibility.

Book Shelves

In order to maintain maximum room use and furniture placement flexibility typical faculty and staff offices shall not have built-in book shelving. Movable bookcases will be provided as Movable Furnishings where indicated in the POR.

Furniture Selection

During the preparation of the POR, the FPC Interior Designer will consult with the User Coordinator to determine only the types and quantity of furniture needed to satisfy functional requirements.

The A/E in their Schematic and Design Development submittals will include furniture layouts to POR requirements to ensure accommodation in the space proposed for doors, columns, etc.

Fixed Seating

All classrooms are to be designed to accommodate left-handed students. Ten percent of the total number of desks shall be for left handed people.

Seating shall be not less than 20 inches in width with preference for 22 inch width.
Specific Campus Information

Tarleton State University

Window Treatments

Levelor Cordless Mark I 1” blinds, lightmaster option.
General Information

Controlled Environment Rooms

Rooms defined as cold room, environmental rooms, plant growth chambers, etc. including controls shall be specified as complete units from a single manufacturer.

The design of refrigeration systems for environmental rooms and growth chambers shall be reviewed by the Mechanical Engineer only for coordination with the building mechanical systems.

Project A/E shall specify that the manufacturer of this equipment shall submit a detailed test procedure for factory testing the first unit of each type and that the Owner will witness the test.
General Information

Elevators

Elevators shall be selected and designed to comply with American Society of Mechanical Engineers/American National Standards Institute safety code for elevators, dumbwaiters and escalators, and moving walks, A17.1, latest revision as well as all requirements from with Texas Department of Licensing and Regulation and Texas Accessibility Standards.

Elevators manufactured by Otis, ThyssenKrupp, and Kone may be acceptable subject to meeting all applicable requirements of this section. Equal quality elevators of other manufacturers will be acceptable subject to approval of the Project A/E, the FPC Project Manager and the Member Facilities Department.

Elevator shall be specified to receive an electronic door safety device that extends the full height of the cab. Mechanical safety edge or traditional two beam photo-electric eyes are not acceptable.

Installation shall be by mechanic directly employed by the manufacturer or by installers franchised by and responsible to the manufacturer.

Electric operated elevators are preferred; however, oil hydraulic operation may be considered where use is intermittent or where elevator serves two floors.

General Contractor's use of elevators will only be allowed with written permission of the FPC Project Manager, Facilities Department and Elevator Vendor. Contractor shall be responsible for protecting interior finishes of all elevators. At Substantial Completion condition all elevators shall be as new. Contractor's use of the elevator even with written permission of the Owner and vendor shall not relieve Elevator Vendor of any warranties expressed or implied. Provide complete inspection and maintenance service of each elevator for a period of 12 months at no cost to Owner. Elevator Vendor shall be able to show that they have had successful experience in the erection and maintenance of the type elevator equipment proposed for this project and that they maintain within 50 miles of the elevator installation an adequate stock of parts for emergency and replacement purposes; and that they have qualified men in their own employ available to insure the fulfillment of any maintenance and/or repair services without delay within one hour notification, 7 days a week on a 24 hour basis. Elevator Vendor must be firms established in operation for the past five years and having a proven selection of parts and service facilities to meet the qualifications stated above for 2 years. The elevator contractor must also be the manufacturer of the elevator being installed.

Provide BIM(s) of elevators to be used. Ensure that the following minimum data is associated with the model: manufacturer, model, number, speed, and capacity.
Passenger Elevators

Speed: 2 through 3 floors travel of 150 ft./min.;
4 and above floors travel of 350 ft./min.;

Capacity: Generally, stretcher number 3500 to 4500 pounds is 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.

Diagnostic Tools: The elevator contractor shall provide to the Owner, integral with and built into the elevator controller, as part of this specification, any and all diagnostic tools and/or instruments and all written operating and instruction manuals needed to use the diagnostic tools required by the specification to allow for adjustment of any and all computer parameters and/or troubleshooting the equipment provided. These diagnostic tools shall be provided at no additional cost to the Owner. The Owner shall not be required to execute any type of written agreement in order to obtain said tools. The use of any handheld or removable diagnostic devices shall be specifically prohibited. The integral diagnostic tools and/or instruments shall permit the Owner and/or his authorized representative to access, diagnose and/or adjust any and all computer and/or software based variable features and/or parameters for the entire lifespan of the new equipment provided as required by the specification.

Operation: Leveling with resistance operation through 150 ft./min.; generator or solid state control for 200 ft./min. and above.

Cab: Stainless steel front and car door, stainless steel base, plastic laminated sides and rear, luminous ceiling with UL approved, manufacturer's Standard concealed fluorescent lighting, exhaust fan, stainless steel handrails on three sides and contain a device for voice communication to meet Texas Accessibility Standards.

The cab should have the following as standard features:

A. Emergency Phone
   1. Hands free, auto dial, flush mount, vandal resistant

B. Door Operators
1. Heavy duty

C. Door Protection/Reopening Device
   1. Infrared electronic scanning

D. Fireman service key switches phases I and II
   1. “Adams” cylinders with WD01 key

E. Cab Lights
   1. Fluorescent or screw-in base with easy access for replacement

F. Vandal-resistant car enclosures
   1. Swing return (hinged) car stations
   2. Hall and car button and fixtures

Hoistway Entrances: 3'-6" min. width, 7'-0" high, baked enamel finish, power operation.

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 hoistway preferred.

Platform: Size according to code for capacity; however, standard sizes should be selected.

Signals: Provide Braille markings on car operating face plate and call signals and other features. One emergency alarm bell button in each car connected to emergency alarm station at main floor. Position indicators, direction arrows, and hall, and car buttons should be L.C.R. or L.E.D. standard 100,000 hour lamps.

Flooring: Same as adjacent area by flooring subcontractor.

Floor Lockout Provisions: Provisions shall be included if directed by FPC Project Manager.
Emergency Generator: Interlock with emergency generator if Emergency Power System is approved for building. Otherwise, make no provision for emergency generator for elevator unless specifically directed to do so by the FPC Project Manager and Facilities Department.

Hooks & Pads: Hooks shall be installed in all passenger elevators. In addition, one complete set of pads shall be furnished for the Contractors’ and Owners’ use during construction. Prior to final acceptance, the pads are to be furnished in good condition and clean to the Owner.

Combination Passenger/Service Elevators

Will be designed to meet requirements of passenger elevators; cab size, hoistway entrances and capacity to meet freight requirements.

Freight 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 2500 pounds; however, product and product weight should be considered.

Control: Same as for passenger elevator operation except for 2 floor installation single automatic pushbutton.

Operation: Same as passenger service.

Cab: Standard freight (steel wainscoting).

Hoistway entrances: Bi-parting type. Generally, door operation is manual; however, consideration should be given to power operation where use of equipment is extensive.

Signals: 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.
Design Criteria
Division 14 – Conveying Equipment

Campus Specific Information

Texas A&M University

Elevator Requirements

Electric operated elevators are required. Oil hydraulic elevators are not acceptable.

Electric elevators: Overhead preferred, but location at lower level optional on installations of four floors and less. Machine-room-less-elevators as manufactured by Kone are acceptable. For machine-room-less elevators, provide a 24” x 24” fire-rated access door near the top of the shaft to access the governor and the brake. This access door shall be located such that the frame of the elevator does not impede access to the governor or the brake. Coordinate location height of access door with manufacturer.

1. Pit
   A. Sumps in pits shall be covered. The cover shall be level with the pit floor.
   B. Interior and exterior of elevator pits shall be water-proofed
      1. Means to prevent the accumulation of water shall be provided.
      2. Removal of water from pit per ASME A17.1.
      3. Sump holes, if used, must be covered with a metal grate flush with the pit’s floor.
   C. Provide, at minimum, the following electrical devices in the elevator pit adjacent to each pit ladder.
      1. Weather proof light fixture.
      2. Weather proof light switch for light fixture.
      3. Weather proof duplex 120V GFCI power outlet.

2. Machine Rooms
   A. A self-closing, self-locking, properly rated machine room door is required.
   B. The elevator machine room shall be properly ventilated, heated and cooled.
C. Provide a 120-volt, 20 amp, circuit for car lights, fan and alarm circuit. This circuit must be provided with a lockable disconnect per NEC 620-53.

D. Provide adequate 120-volt receptacles in each elevator equipment room. Each outlet shall be GFCI.

E. All disconnects located in the elevator equipment room shall be able to be secured with a lock.

F. If battery lowering is specified provide an auxiliary contact on the main disconnect for the elevator equipment. This contact shall be used to determine the difference between a power outage and a maintenance or emergency shut down.

G. Provide a 10-pound ABC fire extinguisher in each machine room.

H. Only such equipment directly required in the function or support of the elevator system is allowed in the machine room or hoist way. No other equipment, piping drains, etc., is permitted in this space.

3. Fire Protection and Alarm Detection

A. Smoke detectors must be installed in each elevator equipment room and elevator lobby. They must be so arranged that if activated, the elevators will go into recall mode. Activation of the smoke detector will recall all elevators to the designated floor.

B. If the building is fully sprinkled, then the following requirements must be met:

1. Sprinklers shall be installed in hoist ways and elevator equipment rooms in accordance with NFPA 13.8.14.5 (not more than 2 feet above the floor of the pit for hydraulic elevators).

2. A heat detector must be installed within 6 inches of each sprinkler head located in the hoist ways or elevator equipment rooms. The fire alarm system must function such that when the heat detector's temperature rating is reached, the fire alarm system shunt trips the main breaker in the elevator equipment room in accordance with ASME A17.1 Rule 102.2 C (3) and (4). A smoke detector shall be installed.
3. Temperature settings for heat detectors and sprinkler heads shall be as follows:
   a. Heat detectors: 175 to 195 degrees.
   b. Sprinkler heads: 200 to 225 degrees (The sprinkler head rating will be picked so as to be approximately 25 degrees higher than the temperature rating of the heat detector.)

4. If elevators are powered from emergency power. Interlock wiring (conduit and wire) must be provided between the transfer switch and each elevator equipment room and between each elevator equipment room.

5. The battery lowering option cannot be provided if the emergency power option is purchased.

6. One analog telephone line per elevator shall be installed in each elevator room.

4. Elevator Cab
   A. Provide an ADA approved flush mounted telecommunications device in each elevator. Use of this device shall not require the opening of a door.
   D. Elevator Car Interior to Controller Communication Requirements
      4. In addition to the emergency phones required to be provided in elevators, separate means shall be provided to enable two-way voice communication between the controller location and the interior of each individual car, complying with the following:
         i. Each two-way communication device must have emergency power back-up for at least 4 hours.
         ii. Each two-way communication device shall not be a part of the existing emergency phones. They shall be installed separately from communication devices already present.
         iii. They shall not require intervention by a person inside the car to establish two-way communication or allow communication to be disconnected from inside the car. All manual operation of the device shall be done by emergency personnel from the controller location and no
operation shall be required of persons inside the elevator car.

iv. Once two-way communication has been established a visual indication within the car shall illuminate and only extinguish when the communication link is terminated by emergency personnel.

v. Operating instructions (AMSE A17.1-2.27.7.3) shall be provided adjacent to the two-way communication device in the controller location.

5. Quality Assurance

A. No variance to the codes shall be sought from the governing authority without written approval from the Facilities Services Elevator Representative.

1. Copies of variances, if granted, shall be submitted to the Facilities Services Elevator Representative for record.

6. Submittals

A. Product Data: including capacities, speed, size, and type.

1. Provide this data at the design stage of the project to verify that the elevator will meet the anticipated traffic and handling demands of the building’s design before proceeding to the development phase of the project.

B. Provide three (3) copies of both full line and schematic diagrams including nomenclature definitions and symbol keys for the entire elevator system.

1. Provide three (3) copies of operating and maintenance manuals, parts lists, diagnostic documentation, sequence operation, and manufacturers’ parts numbers. For the entire elevator system, wire pull sheets shall be left on the job for future trouble shooting and shall become the property of the University.

2. Provide three (3) sets of all keys for all keyed features of the elevator system.

3. Provide any diagnostic tool necessary for maintenance, adjusting, testing, inspecting, and troubleshooting any part of the elevator system.
7. Demonstration and Training

A. On-site training shall be provided by the original equipment manufacturer for enrollment by individuals selected by the Facilities Services Superintendent for Operations Maintenance to learn about installation, adjustment maintenance and troubleshooting the equipment. Any fees or costs of training for up to six (6) persons shall be included in bid price. Fees for additional persons shall be stated in bid and shall be at a reasonable cost.

8. Warranty

A. Written warranty, signed by manufacturer, agreeing to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty period of 12 months

9. Final Acceptance Test

A. All tests required by the authority having jurisdiction (Texas Department of Licensing and Regulation) shall be witnessed by the Facilities Services Qualified Elevator Inspector and shall use the Facilities Services Elevator Equipment Inspection form. This form shall be signed by the Facilities Services Area Maintenance 7 Representative. All inspection reports shall be delivered to Facilities Services Area Maintenance 7.
General Information

The A/E shall identify on the drawings all areas that may be classified as hazardous in accordance with the latest edition of the NFPA Codes or that may pose a health hazard due to noise levels, radiation, chemical fumes, etc. The A/E shall describe how each such area will be treated in the building design.

All CM/GC is responsible for modeling all of the fire suppression system using BIM authoring software.

Fire Suppression Systems

Sprinkler and Standpipe, Hose Systems:

Design and installation of sprinkler systems shall meet FM 2-0 and FM 3-26: Fire Protection Water Demand for Nonstorage Sprinklered Properties unless fire hazards are specifically addressed by other FM Data Sheets (e.g. Co-Generation Plants). Fire protection drawings, calculations and listing of all equipment to be installed should be submitted to FM Global Plan Review Services for review prior to installation. Submittals should be in accordance with the FM Global Plan Review Procedures Document.

General fire protection spacing requirements in Hazard 1, Non-storage occupancies (such as classrooms, lecture halls, etc.) as outlined in the table below:
All piping to be Schedule 80 A-53.

The A/E shall be responsible for modeling, using BIM authoring software, and including in the Construction Documents the Fire Protection Sprinkler System—Sprinkler Head and main header location, plans, riser locations and diagrams. Risers shall include
sprinkler header take-offs with Fire Alarm points located. Drawing shall be laid out to allow for the addition at completion of construction as all as built header and branch piping to each sprinkler head. The Fire Protection Sprinkler 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 its certificate.

Electrical equipment rooms are not required to be sprinkled when the room and equipment conforms to the requirements of NFPA 13.

All materials shall be FM Global approved products and data sheets are available at [www.fmglobal.com](http://www.fmglobal.com). Compliance with Article 5.43.3 of the Texas Insurance Code and NFPA 13 is required. Test drains need to be located at the end of each run with a two inch drain located at the main and piped to a drain or outside.

Hoses need not be installed unless specifically required by other NFPA Chapters.

Grooved pipe is acceptable for fire protection systems.

Provide insulation and heat tracing for fire protection piping in crawl spaces and ceiling spaces at exterior areas such as loading docks, drive thrus, or canopies.

Specify galvanized or cad plated rods and hangers for sprinkler piping. Do not allow black iron rods or shot anchors for hanging sprinkler piping.

Provide a cleaning specification for sprinkler piping.

All sprinkler piping shall be schedule 40 pipe and **fully** reamed.

**Mechanical/HVAC Equipment Rooms:** If the equipment room does not contain oil-filled electrical equipment or other flammable liquids, Fire protection should be designed for 0.15 gpm/sq.ft. over a remote area of 2,500 sq.ft., with a 500gpm hose allowance.

**Electrical Rooms/Switchgear Rooms:** Are **not** required to have fire protection systems if:
- The electrical rooms are provided with a 2-hr fire rated enclosure
- FM Approved Monitored Heat/Smoke Detection is provided
- All wall penetrations are properly sealed with fire-rated material
- The area is kept free of combustibles, and housekeeping polices must be in effect
- No oil-filled transformers or switchgear are present

If oil-filled/oil-insulated switchgear or transformer equipment is present, fire protection should be designed for 0.20gpm/sq.ft über a remote area of 3,000 sq.ft. with a 500gpm hose allowance.
Excerpt from DS3-26 Table 2. Minimum Protection Criteria for Non-manufacturing and Non-Storage Areas with High Floor-to-Ceiling Clearance

<table>
<thead>
<tr>
<th>Occupancy Description</th>
<th>Water Demand (gpm²/ft²)</th>
<th>Exception: Occupancy Description</th>
<th>Water Demand (gpm²/ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet System</td>
<td>Dry System</td>
<td></td>
<td>Wet System</td>
</tr>
<tr>
<td>1. Power houses, utility and equipment rooms. Occupancies relating to utilities, such as heat, light and power generation or transmission, refrigeration or compressor rooms, except as noted. Examples: Engine rooms, power and switch gear rooms, air conditioning equipment rooms.</td>
<td>0.20/0000 (0.200)</td>
<td>1. Operations involving hydraulic fluids</td>
<td>DS 7-98</td>
</tr>
<tr>
<td></td>
<td>0.20/0000 (0.370)</td>
<td>2. No oil-fired electrical equipment or other flammable liquids or gases such as oil lubrication or cooling systems</td>
<td>0.15/0000 (0.150)</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>3. Telephone switchgear rooms</td>
<td>DS 6-12, 5-14 or 5:23</td>
<td>4. Generator rooms</td>
<td>DS 6-12, 5-14 or 5:23</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hose stream demand: 650 gpm (1000 L/min). Duration: 60 min</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupancy Description</th>
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<tbody>
<tr>
<td>Wet System</td>
<td>Dry System</td>
<td></td>
<td>Wet System</td>
</tr>
<tr>
<td>1. Occupancies not involving storage or manufacturing. Examples: Apartments, offices, drafting, hospitals, institutions, hotel rooms, kitchens, libraries, photographic processing areas, restaurants, schools.</td>
<td>0.10/1500 (4/140)</td>
<td>1. Libraries with large stack rooms</td>
<td>DS 2-9</td>
</tr>
<tr>
<td></td>
<td>0.10/1500 (4/140)</td>
<td>2. Storage of electronic media</td>
<td>DS 6-9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DS 6-9</td>
</tr>
<tr>
<td>Hose stream demand: 250 gpm (950 L/min). Duration: 90 min</td>
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<td></td>
</tr>
</tbody>
</table>

**Data Centers:** Wet sprinkler systems or FM Approved preaction systems are recommended, and should include FM Approved smoke actuated fire detection or air-sampling type detectors, automatic emergency shutdown (*manual EPO can be installed for small or non-critical data centers*), and meet the design criteria outlined in FM Data Sheet 5-32. A sprinkler density of 0.15gpm/ft² over 2000sq. ft. should be provided. Where the area is well subdivided, the area of demand should be 2,000sq.ft, or the largest compartmented area whichever is smaller. An FM Approved Water Mist System is acceptable if all criteria outlined in FM Data Sheet 5-32 are satisfied. Hose stream demand in all cases is 250gpm. Sprinklers should be rated for165°F temperature rating. Quick response sprinklers should only be used on wet sprinkler systems. *(See Below for Special Protection Systems)*

**Emergency Generator Rooms:** Provide automatic sprinkler protection in the generator room designed to deliver a density of 0.25 gpm/ft² (10 mm/min) over 4000 ft² (372 m²) (286F sprinklers) plus 500 gpm (1900 l/m) for hose streams.

**Special Systems**

All special protection systems should be installed in accordance with FM 4-0: *Special Protection Systems*, and FM 4-9: *Clean Agent Fire Extinguishing Systems*. These systems should not be installed in any area where moderate to heavy loading of ordinary combustibles will be present (i.e. special collections in libraries, storage areas for Data Centers, etc.)
If special protection systems are to be used in Data Centers, they must be designed in accordance to FM Data Sheet 5-23, specifically 2.4.2.1.1 Gaseous extinguishing, and FM Data Sheet 4-0, Data Sheets 4-2 and Data Sheet 4-9.

Systems designed to protect equipment or special hazard areas shall be an automatic total flooding FM-200 extinguishing system, with fire detection designed to conform to the requirements of the National Fire Protection Association codes and standards (NFPA 2001, NFPA 72, and other applicable codes).

The system shall be designed and installed by an experienced firm regularly engaged with automatic flooding FM-200 fire extinguishing systems. The firm shall have a minimum of five (5) years experience in design, installation, and testing of these systems and shall be certified and licensed by the State Fire Marshal’s Office in accordance with Article 5.43.1 of the Texas Insurance Code.

It there is an FM-200 system the contractor must perform two (2) tests.

**Campus Specific Information**

**Texas A&M University**

**Fire Department Lock Box**

Key Boxes shall be installed on all new buildings or buildings being renovated that do not currently have a key box. The key box shall be located at or near the primary fire department access at eight feet (8’) above the finish elevation. The approved College Station Fire Department key box shall be a “Knox Box.”

The tamper switch shall be connected directly to the Siemens “Apogee” fire alarm system.

**Fire Department Connection**

Fire Department connections shall have Knox FDC Cap Model No. 3010 stainless steel with key wrench.

**Fire Suppression Systems**

Stand pipes and mechanically operated water gongs are required in all buildings having two or more floors. Installation shall conform to the latest version of NFPA 14.

Sprinkler systems with mechanically operated water gongs are required in all buildings. Installation shall conform to the latest version of NFPA 13.
Distance from the fire hydrant to any portion of a new or renovated building shall be less than 300 feet. Distance from fire hydrant to fire department connection shall be less than 100 feet.

EHSD must approve the following:
   a. the type, number and location of fire extinguishers,
   b. alternative fire suppression systems, and
   c. emergency power generator fuel tanks in excess of 1000 gallons

**West Texas A&M University**

**Fire Protection Piping:**

2-1/2 inches and larger:

Piping: ASTM A135 UL listed, threadable, light wall; Schedule 10 black
Mechanical Grooved Fittings: UL Listed and FM Approved, ASTM A536 ductile iron or ASTM A958 cast steel,
Mechanical Grooved Couplings: ASTM A-536 Ductile or Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers.

2 inches and smaller:
Piping: ASTM A135 UL listed, threadable; Schedule 40 black
Fittings: Cast iron or ductile iron, ASTM A126 Class B, ASME B16.4 class 125.
General Information

Provide necessary services, piping, connections, fittings, and fixtures for floor drains, drinking fountains, custodial floor sinks, work room sinks, student laboratories, and toilets as required in the Requested Facilities. Provide a single hose bib with lock shield under the lavatories in each restroom. Provide the capability for a fume hood and shower and dressing capabilities in the Wet Lab area. Use the latest International Plumbing Code for requirements. Submit plumbing calculations with the Design Development submittal. Any changes to the plumbing design and calculations shall be submitted a minimum of one week prior to the first interim Construction Documents review meeting.

Room numbers must appear on plumbing plans and room names where space is available. Column lines or designations shall appear on all plumbing sheets as they appear on architectural and structural sheets.

Plumbing and HVAC systems shall be drawn as separate sheets. These systems may be combined only by written permission of the FPC Project Manager.

CM/GC shall provide as-built BIM(s) of all plumbing piping and valves 2” and larger as well as any plumbing equipment.

Where piping systems are to be installed underfloor, these shall be shown on an underfloor plan and not on the plan prepared for the space above. Floor plans for mechanical systems shall be drawn to show pipes, ducts, etc. on the floor in which they are installed. In general, underfloor plans shall be drawn to show all piping underfloor and, from there up, the systems between each floor slab shall be shown only on the appropriate floor plan.

All construction details shall be shown on the drawings and shall not be bound in the specifications.

All equipment and material specifications shall be bound in the specifications and shall not be shown on the drawings.

Performance data for all plumbing equipment shall be shown in schedules on the drawings. This data may also be included in the specifications but shall be carefully edited for conflicts.

The A/E shall identify on the drawings all areas that may be classified as hazardous in accordance with the latest edition of the NFPA CODE or that may pose a health hazard due to noise levels, radiation, chemical fumes, etc. The A/E shall describe how each such area will be treated in the building design.

Provide frost proof hose bibs and weather proof duplex electrical outlets on exterior of
buildings. Major buildings should have minimum of one hose bib and one electric outlet on each face of building.

Coordinate with the structural for block outs at floor drains.

1. All domestic water to be protected by a reduced pressure backflow preventer.

2. All domestic water interior to the building shall be type L copper with soft solder joining. All underground shall be type K. No joints in inaccessible areas under slabs unless silver soldered.

3. Underground sanitary to be hub and spigot and cast iron. Interior of the building shall be no hub C.I.

4. All underground on campuses located at the coast shall have P.V.C. sanitary systems.

5. All ball valves shall be two piece full port with threaded ends stainless steel ball and stem.

6. All butterfly valves shall be drilled and tapped lugged body or full flanged.

7. All systems shall be sterilized to meet health department requirements.

8. All underground domestic water shall be ductile iron, P.V.C. or copper.

9. All underground gas piping shall be polyethylene with fusion welded anodeless riser turn up.

10. All lab gases shall be installed with type L copper and fuel gas to be installed with schedule 40 black steel pipe interior to the building.

**Metering**

All buildings shall be designed for metering of campus water. All auxiliary areas in a building shall be sub-metered.

**Piping**

Gas lines shall be of all welded black steel construction inside of the building to emergency shut-off valves. Gas lines from valve to lab table or appliances may be screwed black steel with M.I. fittings for 3/4" and smaller. All building gas piping shall be designed and installed in accordance with National Fuel Gas Code, NFPA 54, latest edition.

All control valves shall be listed in a schedule on the drawing showing identification.
number, body size, port size, if applicable, whether normally open or closed, spring range, and CV.

Provide insulation on all roof drain lines and overflow lines and pipes that accept condensate.

All interior water piping shall be type L copper with soft solder joints. For exterior applications where copper tube is specified, it shall be Type K.

Underground sanitary sewer to be cast iron, hub and spigot. No hub cast iron may be used in the interior of the building

Riser diagrams to show all waste, vent, supply piping, and cleanouts.

Provide threaded wall stops at all lavatory and sink water supply piping.

Deionized water piping shall be completely drainable. All low points and traps in the system shall have the capability to drain the system completely prior to starting the system.

Victaulic type couplings may be used for piping in equipment rooms only. Victaulic piping systems may be used on fire protection systems for piping 2-1/2 inches and larger only.

**Plumbing**

Buildings shall be designed to permit gravity flow of sanitary and storm drainage (12 inch maximum storm drain size). Where sewage ejectors or sump pumps are required, they shall be located to have sufficient headroom to pull the pump shaft straight up through the floor plate. Lifting eyes or trolley beams shall be provided to facilitate the removal of the equipment. Emergency power shall be provided if failure of pump would damage or flood electrical or mechanical equipment. A high level alarm shall also be provided.

Pipes penetrating exterior walls below grade must be installed properly to prevent breakage due to building settlement or expansive soil.

All connections to campus distribution systems or public utilities shall be precisely located by dimension or coordinates. Depth of piping shall be shown and inverts will be shown at manholes and other critical points.

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.

Cleanouts shall be located at each bend and every 50 feet in straight runs.
Roof drains shall be run separately from all other storm water sources to outside of the building. All overflow drains shall be piped independently of the roof drain system.

Roof overflow drains shall be designed in compliance with the International Plumbing Code. Scuppers can be used instead of overflow drains.

Caulk all toilets, urinals, and lavatories at the wall interface.

All toilet bowls and urinals to be set within 1/16" of the finished wall.

Provide 1-1/2" P-trap for all lavatories and provide ADA protection where required.

Provide Shokstops on all water piping in toilet battery chases with valve upstream of stop for maintenance. Install either above the ceiling or behind an access door for maintenance at the end of the header.

All no-hub cast iron to be provided with hangers within 18" of the hub on each side.

Provide drum sediment traps for all fume hoods and lab sink drains.

For domestic water supplied to a building, a reduced pressure double check valve assembly is required. For fire protection water supply, a simple double check valve assembly is required.

**Mechanical Equipment Room**

Provide at least one (1) 4" floor drain with trap seal protection in each equipment room. Locate out of walking area, but not under equipment. Connect to sanitary sewer system. Locate one (1) domestic water line hose bib with vacuum breaker in each equipment room for coil washing.

**Rest Rooms**

Each rest room should have at least one 4" floor drain when serving 80 or more square ft. and 3" min. for less area. (Locate under stall partition or where one is not likely to walk). Floor drains shall be provided with automatic trap seal protection. Each rest room shall have supply of conditioned air and a positive exhaust air system.

Coordinate the location of toilet partitions and floor drains. The drain shall be under the partition but not adjacent to the support.

For sanitary cleanouts in or near restrooms, place the cleanout(s) at a higher elevation than the flood rim of the surrounding fixtures.

Each restroom shall have at least one hose bib with a vacuum breaker provided.
Provide stainless steel access doors for restrooms.

**Specific Campus Requirements**

**Texas A&M University**

**Metering**

Domestic Cold Water – the meter shall be exactly like the type manufactured by Rosemount under the product umbrella “Rosemount 8705 magnetic flow meter”. All meters should be equipped with a Rosemount remote transmitter model 8712. Meter should be installed per the manufactures specifications and should be field verified by physical plant – utilities personnel. Approval from the Office of Energy Management must be obtained before sizing the flow meter to ensure it is within allowable flow ranges. Flow wiring from the transmitter will be run to the WAGES PLC.

Domestic Hot Water – The meter shall be exactly like the type manufactured by Rosemount under the product umbrella “Rosemount 8705 Magnetic Flow Meter”. All meters should be equipped with a Rosemount remote transmitter model 8712. Meter should be installed per the manufactures specifications and should be field verified by Physical Plant – Utilities personnel. Approval from the Office of Energy Management must be obtained before sizing the flow meter to ensure it is within allowable flow ranges. Flow wiring from the transmitter will be run to the WAGES PLC.

Irrigation Water – The meter shall be exactly like the type manufactured by Rosemount under the product umbrella “Rosemount 8705 Magnetic Flow Meter”. All meters should be equipped with a Rosemount remote transmitter model 8712. Meter should be installed per the manufactures specifications and should be field verified by Physical Plant – Utilities personnel. Approval from the Office of Energy Management must be obtained before sizing the flow meter to ensure it is within allowable flow ranges. Flow wiring from the transmitter will be run to the WAGES PLC.

**Tarleton State University**

**Plumbing Fixtures**

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<thead>
<tr>
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<tbody>
<tr>
<td>WC</td>
<td>Kohler Kingston K-4330 (wall mount)</td>
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<tr>
<td>HC WC</td>
<td>Kohler Kingston K-4300 (wall mount)</td>
</tr>
<tr>
<td>WC Valve</td>
<td>Sloan Royal #111</td>
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<tr>
<td>Urinal</td>
<td>Kohler Bardon Superior K-4960-ET</td>
</tr>
<tr>
<td>HC Urinal</td>
<td>Kohler Bardon Superior K-4960-ET</td>
</tr>
</tbody>
</table>
Urinal Flush Valve  Sloan Regal #186

NOTE: All water closets and Lavatories shall be on Carriers

Lavatory  Kohler Chesapeake K-1729 (wall mount)
HC Lavatory  Kohler Morningside K-12634

Lavatory Faucet  Kohler Triton K-7401-2A
HC Lavatory Faucet  Kohler Triton K7437-K

Service Sink  Kohler Whitby K-6710

Drinking Fountain  Elkay #EZSTL8C (twin station wall mount)
Apron for DF  Elkay #LKAPREZL

**West Texas A&M University**

Water Piping, above grade in buildings

Copper Tubing: ASTM B88, Type L, hard drawn.
Joints: ASTM B32, solder, Grade 95TA.

Waste lines from waterless urinals shall **NOT** be copper.

For Pipe sizes 2 inch to 4 inch:
Press Fittings: ASME B16.18 or ASME B16.22 copper and copper alloy press fittings conforming to IAPMO PS 117, with EPDM sealing ring factory installed in fitting.
General Information

The design of the mechanical system and other building components shall be integrated together to produce a building that meets the project programmed functional, sustainable and energy requirements. Mechanical systems must be coordinated with all other building systems and features. Mechanical systems in all buildings should be designed to exceed the minimum performance requirements of ASHRAE 90.1-2010 and incorporate cost effective energy conservation measures that do not compromise building performance or occupant comfort. Mechanical systems must be maintainable and all components reliable. The mechanical design and installation of all components and equipment shall allow for eventual removal and replacement.

All mechanical system components shall be manufacturers’ standard commercial product. A standard commercial product is a product that has been sold for a period of at least three years on the commercial market, is listed in the manufacturers’ catalogs and brochures and represents the latest production models.

HVAC systems shall be designed to allow systems to be scheduled off or set-back during unoccupied hours, weekends, and holidays. Allow a small AHU with O/A to be scheduled on to maintain positive building pressure. VAV boxes will be tied to lighting occupancy sensors to allow for zero air flow in unoccupied rooms when lights are off.

The GC/CM is responsible for creating a model using BIM authoring software. All clearances required for maintenance, repair, and adjustment shall be shown for coordination purposes. All mechanical equipment shall be labeled using parametric objects in the model. These labels shall be unique to each piece of equipment. The minimum parametric data required for each piece of equipment is room number (should be automatically generated), manufacturer, model number, and type of equipment. The type of equipment shall be easily identifiable by the object’s name. Care shall be taken to reduce the various sizes of equipment particularly pumps that perform the similar tasks. This will help reduce the various spare parts that need to be stocked to maintain the building.

The model shall be used to derive shop, installation, and as-built drawings.

Label major mechanical equipment with a permanently affixed label containing equipment identification number or bar code as assigned by the facility management software.

System designs shall be evaluated by the design team on the basis of total ownership and operations cost over a period of twenty (20) years, not energy or capital cost alone. Submission of owning and operation cost analysis shall be required at the completion of Design Development phase.

1. Underground piping to be self restrained ductile iron preinsulated.
Design Criteria
Division 23 – Heating, Ventilating and Air Conditioning

2. All valves on underground piping shall be ductile iron butterfly.
3. All gaskets shall be E.P.D.M.
4. All above ground piping to be type L copper or schedule 40 A53 black pipe.
5. All pressure piping shall be tested at 150 psi or greater for 4 hour minimum.
6. All hangers shall be hot dipped galvanized in the crawl space and wet areas and cad plated otherwise.
7. All ball valves shall be two piece threaded 600 with stainless steel ball and stem.
8. All gate valves to be rising stem.
9. All ducts to be fabricated from G-90 galvanized materials.

Ductwork
All spin-ins shall be of the conical type with damper shaft mounted horizontally.

All grilles shall be regulated by a volume damper, when possible, in lieu of an OBD.

All metal components on galvanized sheet metal ducts shall be galvanized materials such as angle stiffeners. Trapeze hangers, rods, straps, etc.

All exposed ductwork to have internal insulation and metal liner and be fabricated from paint grip metal. The use of fiberglass internal duct liner is prohibited.

Provide hangers for all slot diffusers and insulate. Provide detail on drawings.

Provide hinged access doors for duct access.

Provide required upstream straight duct for all air flow measuring station.

Provide air foil turning vanes.

All large round duct to be hung with half-round saddles and rods. Cable hangers are NOT acceptable.

Provide cover plates with appropriate finish for all recessed damper operators.

Provide a duct leakage test procedure.

Verify ALL return air paths.
Verify that there are sufficient dampers in the system to operate as specified, e.g. economizer.

Foil backed tape on ducts is not permitted. Use fiberglass and Benjamin Foster sealant with fiberglass mat embedded in sealant.

All exterior duct insulation shall have a vapor seal and metal jacket applied with fiberglass mesh installed and resealed with vapor barrier sealer.

**Metering**

All buildings shall be designed for metering of campus thermal utilities. All auxiliary areas in a building shall be piped in a manner to allow sub-metering.

**Piping**

In-line pumps are not to be used except for small fractional horsepower circulators.

Piping shall not be buried beneath the lowest floor level except for soil pipe. Piping will not be run in concrete floors. If pressure piping placement under slabs is unavoidable then the piping must be run in a steel pipe sleeve so leakage can be channeled off.

All condensate drain lines shall be insulated to the vertical main. In exposed areas insulation shall be premolded. In unexposed areas the insulation can be foil wrapped.

All hangers on domestic water and hydronic lines shall be installed on the exterior of the insulation.

3/4" is the smallest size for a hydronic pipe to a coil.

All ball valves on insulated piping to have extension handles.

Provide metal jacket on all crawl space piping, exterior insulate piping and mechanical room piping (up to 8'-0" AFF) insulation.

Density of fitting for insulated piping shall be the same as the specified pipe insulation. Use pre-molded fitting insulation, and loose fill are not acceptable.

All auto air vents shall be constructed with a cast iron body and stainless steel ball and seat.

All manual air vents shall be plugged.

All valves preceding pressure gauges shall be needle type with snubbers installed on the
discharge side of the pump.

Do not use red rubber gaskets on hot water lines and heat exchangers. Instead use EPDM or hard Garlock gaskets. Use EPDM gaskets in "push on" joints.

Anchor all condensate lines to floor. Do not gang condensate lines together.

Require high density polyethylene HPDE jacket or high density polyurethane polymer jacket on preinsulated piping. Provide insulation on all chilled water pumps and air separators.

Do not use gate valves in hydronic piping, use ball valves 2" and smaller (e.g. stainless steel ball and stem) and butterfly valves for 2-1/2" and larger.

Butterfly valves shall have ductile iron disc and stainless steel nosing and stem.

Ball valves (HVAC and Plumbing) to have stainless steel balls and stem.

All hangars and associated hardware in crawl spaces, under foundations, and in wet areas shall be hot dipped galvanized. Otherwise, hangars and hardware shall be cadmium plated.

For hydrostatic pressure tests, they are to be performed at either 150psi or 1.5 times the operating pressure, whichever is greater. The pressure tests are to have a minimum duration of four (4) hours.

**Mechanical Equipment Rooms**

Access to equipment rooms shall be direct from hallways. Do not provide entrance through other rooms.

Special attention must be given to control the effects of sound and vibration from mechanical equipment to surrounding spaces.

Provide a curb around all penetrations through the mechanical room floor and all penetrations shall be sealed with appropriate fire stopping material.

Depress the floor of all mechanical rooms 1-1/2” and uniformly slope entire floor to minimum 4 inch floor drain(s). All floor drains to have trap primers and be connected to building sanitary sewer system

Provide positive ventilation in all equipment rooms that are not return air plenums.

Equipment rooms with other equipment than those items directly related to air handling equipment will not be used for return air plenums. The use of rooms as plenums is permissible provided outside air and return air are directed to the plenum
and volume control dampers are provided to control the quantity of each entering the plenum. Each component of an air handling system shall be spaced so there is ample room on all sides for inspection and maintenance (filter removal, bearing replacement, coil replacement, cleaning, etc.) and man sized hinged access doors shall be provided for ready access to the spaces in the air handling equipment. These required clearances shall be included in the BIM for coordination.

Air handlers suspended must be provided with permanent platforms for maintenance. The maintenance platform must be a minimum of 7'-0" clear from floor below.

Provide dedicated 120 VAC duplex electrical outlets for maintenance equipment, and separate mechanical keying with University master keying system.

Provide conditioned, supply air into each mechanical room and electrical room for tempering the air in the space. This may be accomplished with a “spin-in” and manually adjustable damper and branch duct or a variable air volume terminal located in the room.

Flow Diagrams

A basic flow diagram indicating major components for pressurized circulating water systems and air systems will be provided with the Design Development submittal. Detailed flow diagrams to include all line sizes, in-line devices (valves, strainers, control valves, thermometers, pressure gauges, flow measuring devices), and flow quantities for headers and branch lines will be provided in the Construction Documents phase.

Space Conditioning

Provide comfort conditioning winter and summer for all spaces except mechanical spaces. HVAC systems are to be selected, zoned, and designed to efficiently and effectively control the heat and humidity gain (or loss), and gains due to lighting, equipment, personnel, other special loads, and building exposures. Provide a separate system for areas where timing of functional uses may so require.

The Project A/E shall consider systems such as: Variable air volume air distribution, variable speed pumping, dedicated outdoor air handlers to meet the Indoor Air Quality requirements of ASHRAE Standard 62 (Ventilation for Acceptable Indoor Air Quality), Newer ASHRAE Standard energy recovery systems, high efficiency equipment and other accepted and normally utilized strategies to provide an energy efficient building. The Project A/E should be aware of the potential for mold and mildew problems in the humid climate at many of the campuses.

Consider not designing systems that require remote reheat piping to terminal boxes, design systems that locate all water piping in the mechanical rooms, consider dual duct, or multi-zone systems.
Varied levels of air filtration will be required in the building. Give consideration to design features to provide good indoor air quality (IAQ). In addition to filtration, these features would include double wall air handlers with stainless steel drain pans sloped to drain, exterior duct insulation, and provisions for access for duct cleaning.

The A/E shall require controls contractor to supply one, or more, temperature-sensing element(s) in each Air Handling Unit. The sensor shall be required to be installed in a serpentine manner so that at least 75% of the coil’s surface is covered and a representative average temperature can be transmitted to the Energy Management System (EMS). The length of sensor should be one (1) foot of length per square foot of coil area. Air Handling Units' condensate drain pans shall be constructed of stainless steel, pitched two ways per Code, with a minimum 1½” drain connection.

**Ventilation**

Provide power ventilation for restrooms, custodial areas, copy rooms, mechanical spaces, student and research laboratories, building crawl space, as well as other areas where required if there is the possibility of excess heat build-up, as required by code, and by the intended use of the space. The Design Team shall consider the efficiency of the ventilation equipment in their design.

**Laboratory Design**

The primary objective in the design of HVAC Systems for laboratories is to provide a safe environment for laboratory personnel to conduct their work.

General laboratories shall typically have a maximum of 8 and a minimum of 4 air changes per hour. Lighting occupancy sensors shall detect occupancy and operate the lights and adjust ACH based on occupancy.

Laboratories must be maintained under negative pressure in relation to the corridor of other less hazardous spaces.

Fume hoods should not be the sole means of room exhaust. General room exhaust shall be provided to maintain air change rates and temperature control. Install variable speed exhaust fans, do not use constant speed fans with by-pass dampers.

Operable windows are prohibited in laboratories.

Type 316 stainless steel should be used for all parts of the fume hood exhaust system. The exhaust duct should have as few bends as possible and minimal horizontal runs.

The design of the laboratory ventilation system should follow the low pressure drop design concepts developed by Laboratories for the 21st Century.
Fume hoods shall maintain a minimum face velocity of 100 fpm with no measure point less than 80 fpm when the sash is open 18 inches. When the sash is fully open the minimum face velocity shall be 100 fpm with the building lab air supply sized with a 60% diversity factor.

Exhaust Fan Assembly:

The exhaust fan assembly shall be located on the roof or external to the building (penthouse?). The fan shall be either a mixed-flow dilution fan or industrial single width centrifugal type. Fan may be either belt-driven or direct drive, with motors isolated from the exhaust airstream and accessible from the fan exterior for inspection and service. Fan shall be AMCA 99 certified for Spark Resistant Construction. Fan shall be coated inside and out with coating suitable for products being conveyed. All fasteners shall be 316 stainless steel.

Fan and stack shall meet the requirements of ANSI Z9.5 for discharge velocity and stack height, unless a wind tunnel study can verify a lower discharge velocity or stack height will not be detrimental to occupants and air intakes for the building under design and the surrounding buildings.

Refer to Division 11 in the Facility Design Guidelines for additional fume hood requirements.

**Acoustics**

Provide sound traps in the ductwork, noise suppression devices in the design of piping and equipment and other acoustical or vibration control as required. Design Team shall provide all acoustic calculations a minimum of one week prior to the 100% Detailed Design for the noise levels at each air handling unit and mechanical room.

The Variable Air Volume (VAV) terminals and fan powered terminals shall be sized to have a room Noise Criteria (NC) rating so that the final discharge, or radiated sound pressure does not exceed the recommended values in Table 11 of Chapter 7, Sound and Vibration, of the 2001 American Society of Heating, Refrigerating, Air-Conditioning Engineers, Inc. (ASHRAE) Fundamentals Handbook.

Fan powered terminals shall be located outside of any noise sensitive areas. Refer to Requested Facilities section for identification of specific areas. More stringent criteria may be required in some areas.

Corresponding requirement for sound attenuation shall apply to the Variable Air Volume (VAV) terminals and fan powered terminals serving these areas.
Calculations for HVAC Design

Submit cooling and heating load calculations for each individual zone in the building’s HVAC system and sizing data for all applicable proposed equipment such as air handling units, VAV terminals, boilers, fan/coils, pumps, etc. for piping systems along with the 50% Construction Documents submittal. Also, provide representative “cut sheets” for equipment and materials.

Each zone calculation shall indicate, at a minimum: individual rooms, total and sensible loads, and air flow requirements. The heating and cooling loads shall represent all loads: people loads (including diversity factors), appliances, fresh air for ventilation in accordance with ASHRAE Standard 62.1, and external loads (e.g. solar and fenestration). Calculations shall be performed using a standard HVAC load calculation program such as: Elite Software’s CHVAC, DOE2, Carrier’s E20 or HAP, Trane Tracer, or other software regularly used and accepted in the HVAC industry.

The engineer shall submit necessary calculations to verify the design meets the requirements of ASHRAE Standard 62.1. This shall be in the form of calculations indicating that the necessary outside air is supplied to each system, or zone, to comply with the requirements of the ASHRAE Standard. Where the engineer utilizes diversity factors and the multiple spaces portions of the Standard to supply the required outdoor air for ventilation, he must also submit documentation verifying the requirements of the Standard are met.

Mechanical and Electrical General

Room numbers must appear on air conditioning and electrical plans and room names where space is available. Column lines or designations shall appear on all MEP sheets as they appear on Architectural sheets.

Plumbing and air conditioning systems shall be drawn as separate drawings. These systems may be combined on common drawings only by written permission of the FPC Project Manager.

Where piping systems are to be installed underfloor, these shall be shown on an underfloor plan and not on the plan prepared for the space above. Floor plans for mechanical systems shall be drawn to show pipes, ducts, etc. on the floor in which they are installed. In general, underfloor plans shall be drawn to show all piping underfloor and, from there up, the systems between each floor slab shall be shown only on the appropriate floor plan.

All construction details shall be shown on the drawings and shall not be bound in the specifications.

All equipment and material specifications shall be bound in the specifications and shall
not be shown on the drawings.

Performance data for all mechanical and electrical equipment shall be attached to objects as parametric data. The data shall be used to derive schedules on the drawings. The data may also be included in the project specifications. Data shall be linked between the object and schedule to ensure that the correct data is updated at all locations.

The A/E shall identify on the drawings all areas that may be classified as hazardous in accordance with the latest edition of the NFPA Code or that may pose a health hazard due to noise levels, radiation, chemical fumes, etc. The A/E shall describe how each such area will be treated in the building design.

The A/E shall design the facility to connect to the central utility systems as available and as directed in the POR.

**Design Conditions**

The following information should be clearly shown on the General Information Sheet. Additions and deletions may be required if package unit equipment is incorporated in the design of facilities.

<table>
<thead>
<tr>
<th>Mechanical</th>
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<tbody>
<tr>
<td>Summer Outside</td>
<td>(°F.D.B.) (°FWB)</td>
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<td>Summer Inside</td>
<td>(°F.D.B.) (%R.H.)</td>
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<td>Winter Inside</td>
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<td>Total Cooling Capacity</td>
<td>(Tons) Total Connected load of Building</td>
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<td>Total Cooling Max. Demand</td>
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<td>Total Heating Capacity</td>
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<td>(gpm)</td>
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<td>Gas, natural</td>
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Determine the economic feasibility of incorporating solar energy for space heating,
cooling, and water heating into the building design and proposed energy system.

Economic feasibility for each function shall be determined by comparing the estimated cost of energy procurement using conventional sources and energy systems with the estimated cost of using solar energy during the economic life of the proposed building.

**Boilers**

Specifications for boilers to include the following:

1. Chemically treat and flush boiler system prior to initial startup.
2. Begin internal boiler treatment with chemical comparable with JD-701 (Fort Bend Services).
3. Provide and install an automatic blow down system.
4. Provide and install a conductivity meter.

**Hydronic Piping Cleaning Guidelines**

- Cleaning and Flushing of piping systems must be done by an independent, third party company that specializes in this type of work
- Submit detailed plan for Engineer’s and Owner’s review and approval prior to any piping being installed. Plan shall describe in full detail the individual steps associated with this process before any piping is installed. Plan must include a drawing indicating phasing of systems to be cleaned, locations of drains or other temporary connections required for cleaning system, recommended time for cleaning agent circulation and clean water flushing, and cut sheet of proposed temporary pump(s).
- Clean and flush thoroughly to remove construction debris (e.g., rust, dirt, piping compound/dope, mill scale, oil, grease) and contamination before placing pipe in service. Provide necessary temporary connections, bypass piping or hoses and valves that are required for cleaning, purging and circulating. Provide temporary bypasses around AHUs, fan coil units, and cooling and hot water coils. Bypasses are to be the same size as the supply and return pipe size. Also, do not flush through chillers, cooling towers, pumps, or other equipment. Remove flow meters from building piping prior to cleaning/flushing operation.
- Cleaning & Flushing fluid velocities are to achieve a minimum velocity of 10 ft/sec to achieve a thoroughly clean system, free of construction debris and contamination before placing piping systems in service.
- Cleaning chemicals/agents must be environmentally friendly. Submit chemical cut sheets to Owner for approval prior to cleaning.
- Third party is to provide their own temporary pumps and connections as required to achieve minimum velocities for cleaning, purging and circulating. Likewise, third party is to provide temporary strainers necessary to protect sensitive equipment and components during cleaning/flushing process.
• Install temporary strainers in front of pumps, tanks, solenoid valves, control valves, and other equipment where permanent strainers are not indicated. Keep these strainers in service until the cleaning and flushing process has ended and the system has been deemed clean and ready for use. Then remove the entire strainer or strainer element only. Replace the strainer basket and gasket. Contractor shall notify Owner so that the reinstallation of clean strainer screens may be witnessed.
• Do not flush thru our coils (AHUs or air boxes) – normally only up to the isolation valves.
• Discharge the “dirty” water to the sanitary waste stream – NOT the storm drains.
• After systems have been cleaned and flushed, third party to provide a written certification that the systems are clean and ready for use.

Campus Specific Information

Texas A&M University

Mechanical systems shall be designed to exceed the minimum performance requirements of ASHRAE 90.1-2010 by 20% in new construction, and 15% in existing building renovations. Additionally, all projects are required to earn 5 points within EA credit 1, under the USGBC’s LEED 2009 rating system.

Chilled Water (CHW) and Heating Hot Water (HHW) Systems

The Project A/E shall refer to Utilities & Energy Services – Design Standards & Guidelines for additional information. This can be found at https://utilities.tamu.edu/design-standards/

Metering

The Project A/E shall refer to Utilities & Energy Services – Design Standards & Guidelines for additional information. This can be found at https://utilities.tamu.edu/design-standards/

Central Plant Utility Systems

The Texas A&M University Utilities and Energy Management produces and distributes all of the utility services required by academic, general purpose and research facilities. The following are design criteria for the central utilities systems which should be used in the design of building systems which are connected to the central system.

Chilled Water: Shall not be used for any purpose other than comfort space conditioning.

Chilled Water temperature is reset based on outside air temperature.
● O/A less than 40 deg.f. CHW = 48 deg.f.
● O/A from 40 to 50 deg.f. CHW = 46.5 deg.f.
● O/A from 50 to 60 deg.f. CHW = 45 deg.f.
● O/A from 60 to 70 deg.f. CHW = 43.5 deg.f.
● O/A greater than 80 deg.f. CHW = 42 deg.f.

Consult Texas A&M Utilities and Energy Management for supply and return pressure data.

**Heating Water:** Shall not be used for any purpose other than comfort space conditioning.

Heating Hot Water temperature is reset based on outside air temperature.

● O/A less than 30 deg.f. HHW = 180 deg.f.
● O/A from 30 to 40 deg.f. HHW = 170 deg.f.
● O/A from 41 to 50 deg.f. HHW = 160 deg.f.
● O/A from 51 to 60 deg.f. HHW = 150 deg.f.
● O/A greater than 60 deg.f. HHW = 140 deg.f.

Consult Texas A&M Utilities and Energy Management for supply and return pressure data.

**Domestic Hot Water:** Consult Texas A&M Utilities and Energy Management for pressure and temperature data.

Large users shall be connected to central system if in close proximity to existing distribution system. Small users may generate their own domestic hot water with gas or electric heaters. Heating water shall not be used as the heat source in producing domestic hot water.

**Compressed Air:** Consult Texas A&M Utilities and Energy Management for the availability of centrally produced compressed air for laboratory and instrumentation usage. Do not use for space conditioning instrument except as back-up for reliability.

**Steam:** Consult Texas A&M Utilities and Energy Management for the availability of centrally produced steam.

**Condensate:** Consult Texas A&M Utilities and Energy Management for condensate return data.

**Domestic Water:** Consult Texas A&M Utilities and Energy Management for pressure data.

**Sanitary Sewer:** All buildings with sanitary facilities will be tied into the sanitary sewer system.
Project A/E shall consult with and obtain the approval of the Department Head of System Member Environmental Health & Safety Department, Department Head of System Member Utilities and Energy Management Department and Director of Project Delivery, Facilities Planning and Construction prior to the anticipated use of the sanitary sewer system for the disposal of animal waste.

**Storm Sewer:** Used exclusively for rainfall run-off.

**Prairie View A&M University**

**Central Plant Utility Systems**

The Prairie View A&M University Utilities Plant produces and distributes the following utility services required by academic, general purpose and research facilities. The following are design conditions for these systems.

**Chilled water:** Shall not be used for any purpose other than comfort space conditioning.

Supply: Pressure: 60 psi Normal, 95 psig Max.
Temperature: 43°

Return: Pressure: 45 psi
Temperature: 54°F

**Domestic Hot Water:** Large users shall be connected to central system unless otherwise specified in Program of Requirements. Small users shall generate their own Domestic hot water utilizing steam as the heat source.

Pressure: 60 psig Max., 50 psig Normal
Temperature: 140°F

**Steam:**

Pressure: 150 psig and 15 psig

**Condensate:**

Return Header Pressure: 15 psig

**Domestic Water:**

Pressure: 54 psig
Sanitary: All buildings will be connected to this system. Do not use for storm drainage.

Storm Sewer: Used exclusively for rainfall run-off. Buildings shall have roof drain systems conveyed to underground storm sewers.

Tarleton State University

Central Plant Utility Systems

The Tarleton State University Utilities Department provides the following utility services required by academic, general purpose and research facilities. The following are design and general conditions for these systems.

Steam:

| Pressure | 20 psig |
| Temperature | 259°F |

Condensate:

Return Header Pressure: Gravity

Domestic Water:

| Pressure | 55 psig |

Sanitary Sewer: All buildings will be connected to this system. Do not use for storm drainage.

Storm Sewer: Used exclusively for rainfall run-off. Buildings shall have roof drain systems conveyed to underground storm sewers.

Texas A&M University at Galveston

Central Plant Utility Systems

The Texas A&M University at Galveston Utilities Department provides the following utility services required by academic, general purpose and research facilities. The following are design and general conditions for these systems.

Chilled Water: Shall not be used for any purpose other than comfort space conditioning.

| Supply: Pressure | 45°F |
| Temperature: |
Return: Pressure
Temperature: 56°F

Heating Water:

Supply: Pressure
Temperature: 180°F

Return: Pressure
Temperature: 150°F

Domestic Water:

Pressure:

Sanitary Sewer: All buildings will be connected to this system. Do not use for storm drainage.

Storm Sewer: Used exclusively for rainfall run-off. Buildings shall have roof drain systems conveyed to underground storm sewers.

West Texas A&M University

Chilled Water Piping:

Steel Pipe: ASTM A53, Schedule 40, 0.375 inch wall for sizes 12 inch and over, black.

2 inch and Smaller:
Fittings: ASTM B16.3, extra heavy malleable iron class 250 or ASTM A234, forged steel welding type.
Joints: Threaded or AWS D1.1 welded.

2-1/2 inches and larger – in mechanical rooms and crawl spaces.
Mechanical Grooved Fittings: ASTM A536 ductile iron, grade 65-45-12
Mechanical Grooved Couplings: ASTM A-536 Ductile iron housing clamps to engage and lock, "C" shaped EPDM elastomeric sealing gasket, steel bolts, nuts, and washers.

2-1/2 inches and larger – in concealed spaces, above finished spaces, and all connecting piping to air handling units.

Fittings: ASTM A234 forged steel welding type, Class 300.
Joints: AWS D1.1 welded.

Heating Water Piping:
2-1/2 inches and larger:
Steelpipe: ASTM A53, Schedule 40, 0.375 inch wall for sizes 12 inch and over, black.

2-1/2 inches and larger – in mechanical rooms and crawl spaces.
Mechanical Grooved Fittings: ASTM A536 ductile iron, grade 65-45-12
Mechanical Grooved Couplings: ASTM A-536 Ductile iron housing clamps to engage and lock, "C" shaped EPDM elastomeric sealing gasket, steel bolts, nuts, and washers.

2-1/2 inches and larger – in concealed spaces, above finished spaces, and all connecting piping to air handling units.

**Fittings:** ASTM A234 forged steel welding type, Class 300.
Joints: AWS D1.1 welded.

2 inches and smaller:
Copper Tubing: ASTM B88, Type L, hard drawn.
Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

For copper Pipe sizes 3/4 inch to 2 inch:
Press Fittings: ASME B16.18 or ASME B16.22 copper and copper alloy press fittings conforming to IAPMO PS 117, with EPDM sealing ring factory installed in fitting.

**Medium and High Pressure Steam Piping (150 PSI Maximum)**

Steel Pipe: ASTM A53, Schedule 80, black.
Fittings: ASTM B16.3 malleable iron Extra Heavy
Joints: AWS D1.1 welded.

**Low Pressure Steam Piping (15 PSI Maximum)**

Steel Pipe: ASTM A53, Schedule 40, black.
Fittings: ASTM B16.3 malleable iron Extra Heavy
Joints: AWS D1.1, welded.

**Medium and High Pressure Steam Condensate Piping**

Steel Pipe: ASTM A53, Schedule 80, black.
Fittings: ASTM B16.3 malleable iron, Extra Heavy
Joints: Up to 1 inch: Threaded, or AWS D1.1, welded for all piping above 1 inch.

**Low Pressure Steam Condensate Piping**
Steel Pipe: ASTM A53, Schedule 80, black.
Fittings: ASTM B16.3 malleable iron Extra Heavy
Joints: Up to 1 inch: Threaded, or AWS D1.1, welded for all piping above 1 inch.
Guide Specification

Testing, adjusting and balancing of the air conditioning system, related to ancillary equipment and the domestic water system will be performed by an impartial technical TAB firm selected and employed by the owner

Air Handling Units for Design & Construction

1. Install thermometers and pressure indicators in the hydronic coil piping. Don’t rely on the EMS to read these values.

2. Flushing the piping loop(s), primary and secondary, is essential for a dependable maintenance free system. The engineer, or his designate, should be present during the flushing. This will mean a good specification delineating the goals and the definition of what is an acceptable measure of what “a clean piping system” is.

3. Temperature sensors across coils. For best results, temperature sensors on coils should be sized for: In mixing plenums the length of the element should be two (2) feet in length for each square foot of coil area. In other applications the length of the element should be one (1) foot in length for each square foot of coil area.

4. Averaging-type sensors should be installed in a serpentine manner uniformly across the coil cross-section, with radius clips at each bend of the sensor in the coil supporting the sensor.

5. Multiple sensors can be wired in a series/parallel arrangement for complete coverage in plenums. As an alternative, for larger mixing plenums, it may be advantageous to install several analog-input points on the controller. This arrangement allows software averaging of temperatures for control while providing individual temperature indication to monitor stratification conditions with worse-case conditions triggering a software alarm.

6. Double wall casings are required on all air handling units. Gauge thickness shall be no less than 18 gauge exterior and 20 gauge interior. Insulation shall be a minimum of R-12 and conform to NFPA standard 90 requirements. All exterior wall panels shall be made of ASTM A653 G90 galvanized steel and built on a minimum of six inch rails. Units shall have access doors, minimum 15½” width, to access both sides of the coils, filters, fan section and mixing box sections.

7. Interior wall panels may be made of perforated ASTM A653 G90 galvanized steel for sound attenuation. However, other methods, i.e. external methods and devices, of sound attenuation are preferred.

8. Drain pans shall be of double wall construction with a stainless steel inner liner, sloped both ways to a single outlet with a minimum of 2” of uncompressed insulation,
with a minimum condensate connection of 1” NPT stainless steel. Drain pans shall extend downstream of the coil far enough to contain moisture carry-over. Drain pans must be accessible for inspection and cleaning.

9. Cooling coils shall contain a minimum of 6 rows, tube diameter of either ½” with a minimum .025” wall thickness or ⅝” with .028” wall thickness and maximum of 10 fins per inch, and fin thickness of not less than .006 inches.

10. Air handling units shall be constructed to facilitate easy removal of the coil without disassembly of the cabinet. At the manufacturer’s option, the coils may be installed on tracks to facilitate removal.

11. Coils shall comply with ARI Standard 410 for capacity, pressure drops and selection procedure. Where stacked coils are required in large units, the manufacturer shall provide for a means to collect and drain the condensate from the top coil to the drain pan without impingement on the lower coil.

12. If the campus is in excess of 50 miles of the Gulf coast coil tubing shall be copper with aluminum fins. If the campus is within 50 miles of the Gulf coast, tubes and fins shall be copper or, at the engineers’ option, heresite coated aluminum fins.

13. Coil casing shall be stainless steel for chilled water coils. Any penetrations shall have rubber grommets and fully sealed for pressurization and insulated from the casing insulation.

14. Bearings shall self aligning, antifriction type with a life of 200,000 hours of L-10 life with external grease fittings. All bearings shall be factory lubricated and equipped with standard hydraulic grease fittings and lube lines extending to the motor side of the fan.

15. All units with a motor rated at 10 horsepower and larger, shall be furnished with and internal 120 VAC marine light. Lights shall be a weather-resistant, gasketed, incandescent light. Air Handling Units shall also incorporate an inspection window constructed of glass reinforced with safety wire and installed in the fan section on the side from which the belt drives are visible.

16. All units shall have a single point of connection for the electrical service to the unit. The manufacturer shall seal the conduit to the motor with “Sealtite” to prevent condensation in the motor connection housing.

17. Safety latches shall be required on the fan section.

18. Minimum space between the coils in the air handling units shall be 15½” for cleaning coils.
19. Fans for air handling units shall be backward inclined or airfoil centrifugal type certified as complying with ARI 430-89. A/E shall specify the total static pressure and either the brake horsepower or impeller diameter. Fans shall be rated and certified in accordance with ARI Standard 430. All airfoil fans shall bear the ACMA seal. Fan Modulation – VFDs, dampers or inlet guide vanes are not acceptable. Fans shall have internal vibration isolation installed under the fan and motor.

20. Impellers shall be either aluminum or herisite coated. Motors shall be premium efficient rated for VFD operation shall be inverter duty type and capable of withstanding repeated peaks of 1600 volts at 0.1 microsecond rise time. Comply with NEMA MG-1 Part 31, where applied with and of type F insulation NEMA MG 1-10.38 with H rise.

21. Air handling unit installation shall utilize a method to measure the outdoor air flow rate and adjust the outdoor air flow rate to meet the ASHRAE 62-2001 standard. In addition, the A/E shall consider methods of controlling the systems to ensure compliance. For example, a “polling” system for VAV terminals and utilizing the EMS to comply with the ASHRAE 62-2001 standard.

22. Filters – Type, sizes, etc. shall be specified by the A/E and based on the individual application and use for the Air Handling Unit. Efficiency shall be specified by the “dust spot method” in accordance with ASHRAE Standard 52. Minimum efficiency shall be 30% unless otherwise approved by the System Mechanical Engineer. Consider a secondary filter of 60% efficiency.

23. There is a difference in design requirements for AHUs operating under positive pressure (blow through) and negative (draw through) pressure.

A positive pressure trap should have a weir depth of the total expected static pressure plus ½”. This static pressure can be gauged based on the worst case of the fan being “deadheaded” at the full rated speed allowed by the Variable Speed Drive (VSD).

However, a negative pressure trap should have a total depth equal to: 1” for each 1” of maximum negative static pressure, an additional 1”, the weir height, and the pipe diameter and exterior insulation. The weir height should be half of 1” for each 1” of maximum negative static pressure plus the additional 1”.

Without a trap, or if the trap is improperly designed, air will be drawn into the inside of the fan and AHU casing. In a negative pressure situation, this results in water from the condensate pan spraying the inside of the unit. This will eventually result in damage to the equipment and mold and mildew growth.

In a negative pressure situation, if the trap is too tall or too short, water can be drawn back up into the condensate pan and result in flooding the interior of the unit or dry out allowing air intrusion and water spraying into the unit. Using the proper seal height will prevent these problems. The consultant shall not leave the trap design to the contractor.
Guide Specification

Variable Air Volume Terminal Units for Design & Construction

1. Casing - Terminals shall be constructed of a minimum 20 gauge G90 galvanized steel as per ASTM A 653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dipped Process, capable of withstanding a 125 hour salt spray test as per ASTM B-117, Standard Practice for Operating Salt Spray (Fog) Apparatus. Terminal casing shall be assembled with fasteners. Spot welded assemblies are not acceptable. Casing less than 36” wide min 22 gauge; greater than 36” min 20 gauge.

   Internal Liner - Casing shall be internally lined with minimum 1” thick dual density (1.5 pounds per cubic foot with 4 pounds per cubic foot face) fiberglass insulation rated for a maximum air velocity of 3,600 feet per minute. Insulation shall be fastened with adhesive complying with NFPA 90A. The insulation shall also use spot welded “stick pins” to ensure the insulation is securely fastened. Using adhesive to fasten the insulation to the casing is not acceptable. Insulation minimum “U” value shall be 0.24 Btu/hr-ft²-°F. Insulation shall meet or exceed the requirements of UL 181 and NFPA 90A. Raw insulation must be covered with a metal liner to eliminate flaking of insulation during installation. Simple “buttering” of raw edges with an approved sealant is not acceptable.

   Options -

   Foil faced insulation – interior insulation shall be covered with scrim backed foil facing. All insulation edges shall be covered with foil or metal nosing. Insulation shall meet ASTM C 1136 Standard Specification for Flexible Low Permeance Vapor Retarders for Thermal Insulation, and ASTM 665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing, for biological growth in insulation.

   Engineers shall specify terminals with a fiber-free close cell electrometric foam liner. (This is to be used for job specific laboratories) Liner shall not absorb water, be smooth, erosion resistant and washable. Liner shall be acoustically superior to standard dual density fiberglass insulation. Liner shall comply with the following Standards: NFPA 90A – Supplementary materials for air distribution, ASTM E84 and UL 181 (25/50) Smoke and Flame spread, ASTM C1071, G21, and G22 no bacterial or fungal growth

   Control Assemblies, hot water heating coils, electric heating coils shall not extend beyond the top and bottom of the unit casing.

2. Maximum Static Pressure Drop - At the inlet velocity of 2,000 feet per minute, the static pressure drop across the basic terminal or basic terminal with a sound attenuator shall not exceed .08” w.g for all unit sizes.
3. Primary Air Valve - the primary air valve shall consist of a minimum 22 gauge cylindrical body that includes embossed rings for structural rigidity. The damper blade shall be connected to a solid shaft by means of an integral molded sleeve which does not require screw or bolt fasteners. The shaft shall be manufactured of a low thermal conducting composite material, and include a molded damper position indicator visible from the exterior of the unit. The damper shall pivot on in self lubricating bearings. The damper actuator shall be mounted on the exterior of the terminal for ease of service. The valve assembly shall include internal mechanical stops for both full open and closed positions. The damper seal shall be secured without the use of adhesives. The air valve leakage shall not exceed 1% of maximum inlet rated pressure at 3.0” w.g. inlet pressure.

Air leakage thru the primary air valve shall not to exceed 2% (or 5%) of the nominal catalog flow at 3.0” w.g.

4. Airflow Sensor - Differential pressure airflow sensor shall traverse the duct using equal cross sectional area or log-linear traverse method along two perpendicular diameters. Single axis sensor shall not be acceptable for ducts 6” in diameter or larger. A minimum 12 total pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. A sensor that delivers the differential pressure signal from one end of sensor is not acceptable. The sensor shall output an amplified differential pressure signal that is at least 2.5 times the equivalent velocity pressure signal obtained from a conventional pitot tube. The sensor shall develop a differential pressure of 0.03” w.g. at an air velocity of 400 feet per minute. Documentation shall be submitted which substantiates this requirement. Brass balancing taps and airflow calibration charts shall be provided for field airflow measurements.

The airflow sensor shall be a cross, i.e. two sensor elements that are the full diameter of the inlet duct connection and at 90° to each other. Single axis sensors will not be acceptable. The sensor shall develop a differential pressure of 0.03” w.g. at air velocities of 450 feet per minute or less. Consultant shall require submittals certifying the sensors do have this capability.

5. Hot Water Coils - where required by the schedules or on the drawings and shall be included in the terminal. The coil shall be manufactured by the terminal unit manufacturer (or approved coil manufacturer) and shall have a minimum of 22 gauge galvanized sheet metal casing with a minimum G90 coating. Stainless steel casings, with a baked enamel paint finish, may be used as an alternative. Coil to be constructed of pure aluminum fins with full fin collars at assure accurate fin spacing and maximum tube contact. Fins shall be spaced with a minimum of 10 fins per inch and mechanically fixed to seamless copper tubes for maximum heat transfer. Each coil shall be tested at a minimum of 350 psig under water.

0.50” tube diameter with 0.017” wall thickness fins of 0.0045” thickness tested and certified in accordance with ARI Standard 410. Casing material. Specify who is to supply control valves, air vents and drain valves.

Engineer shall specify that any coil bends or parts exposed to the outside of the
terminal shall be insulated to prevent condensation.

6. Electric Resistance Heating Elements - where required by the schedules or on the drawings and shall be included in the terminal. Heater shall be manufactured by the terminal manufacturer (or approved coil manufacturer), and shall be ETL listed. The electric resistance heating element cabinet shall be constructed of not less than 20 gauge galvanized steel with a minimum G 60 zinc coating. Stainless steel casings or galvannealed steel casings with a baked enamel paint finish may be used as an alternative. The electric resistance heating cabinet shall have a hinged access panel for entry to the controls.

   The electric resistance heating element shall be factory installed to the terminal with heating elements located upstream of the airflow control damper to uniform velocity profile over elements. Elements located downstream of the damper are not acceptable.

   An electrical disconnect shall be mounted on the terminal box and shall render the heater non-operable. Heater shall be furnished with all of the controls for safe operation and full compliance with the UL 1995 and the National Electric Code, latest edition.

   Single point access for electrical and multiple access doors if they have more than one motor.

   The electric resistance heating element cabinet shall have a single point electrical connection. The connection shall include a disc-type automatic reset high temperature limit, secondary high limit(s), airflow switch, Ni-Chrome elements, and fusing per UL and NEC. Heater shall have complete wiring diagram with label indicating power requirement and kw input.

7. If the Consultant determines sound attenuators are required, it shall be provided and scheduled on the drawings to meet acoustical performance requirements. The attenuator and terminal unit shall be of single piece construction. Attenuator shall be constructed the same as the base terminal. Terminals shall meet the requirements of ARI Standard 885-98 for sound.

8. Multi-Outlet Plenums - if the Consultant determines a multi-outlet plenums are required, they shall be provided where scheduled on the drawings. The multi-outlet plenums shall have balancing dampers at each outlet with a locking quadrant. Multi-outlet plenums shall be constructed the same as the base terminal.

9. Fans - fan powered terminals shall be utilize a forward curved, dynamically balanced, galvanized wheel with a direct drive motor. The motor shall be permanent split capacitor type with three separate horsepower taps. Single speed motors with electronic speed controllers are not acceptable.

   The fan motor shall be unpluggable from the electrical leads at the motor case for simplified removal (open frame motors only). The motor shall utilize permanently lubricated sleeve type bearings, include thermal overload protection. The motor shall be mounted to the fan housing using torsion isolation mounts properly isolated to minimize vibration transfer.
The terminal shall utilize an electronic (SCR) fan speed controller for aid in balancing the fan capacity. The speed controller shall have a turn down stop to prevent possibility of harming motor bearings.

Options –

1. The Consultant shall examine and determine if the use of ECM motors for the terminals can be economically justified. The terminal shall include a rectifier and filter for AC power to condition the power to the fan.

2. If the use of ECM motors requires additional electrical circuiting or grounding, the design electrical engineer shall notify the design mechanical engineer in writing. The Texas A&M University System Mechanical and Electrical Engineers shall also receive this notification. Prior to proceeding with the design incorporating any ECM motors, concurrence is required by the System Mechanical and Electrical Engineers.

10. Filter Racks - terminals shall contain a filter rack capable of holding a 1” thick filter. Filters shall be secured with quick release clips, allowing removal without horizontal sliding.

Option - at the Consultant’s discretion, the terminal shall include a V- bank or similar design to ensure the filter velocity is below 600 feet per minute. Field fabricated racks are not acceptable.

11. Casing leakage rates shall be determined by design engineer.
General Information

Automatic Temperature Controls

Provide a temperature control/energy management system and control function for the entire building. The system shall include a standalone Direct Digital Control (DDC) System. This system shall communicate with the Central EMS at the Facilities Services Department through an Ethernet card and the campus instrumentation control distribution wiring system.

The EMS/Automatic Temperature Control (ATC) system must be compatible with the existing campus system. Systems or building components to be monitored and/or controlled by the central campus systems include, but are not limited to, the following: temperature control, temperature and humidity control of the greenhouse areas, fire alarm, security, outside building lighting, and the start and stop of major equipment. Monitoring of specific mechanical equipment and systems will be dependent on the recommendations of Facilities Department.

Provide metering of utilities with indication and totalization capabilities.

Energy Management System

Provide a stand-alone direct digital control (DDC) system for space conditioning in campus buildings connected to the central campus EMS system. During the design development and construction documents phase, consult with the respective controls firm in order to determine the number of DDC Panels required and the location for each panel. The panel locations shall be shown on the detailed design drawings.

Campus Specific Information

Texas A&M University

Landis Division, Siemens Building Technologies, Inc.

Tarleton State University

Johnson Controls, Inc.

Prairie View A&M University

Johnson Controls, Inc.
Texas A&M University at Galveston
Landis Division, Siemens Building Technologies, Inc.

Texas A&M University-Corpus Christi
Landis Division, Siemens Building Technologies, Inc.

Texas A&M International University
Landis Division, Siemens Building Technologies, Inc.

Texas A&M University-Kingsville
Landis Division, Siemens Building Technologies, Inc.

West Texas A&M University
Johnson Controls, Inc. (Electronic, no pneumatics)

Texas A&M University-Commerce
TAC Americas, Inc.

Texas A&M University-Texarkana
South Campus and Main Campus
Landis Division, Siemens Building Technologies, Inc.

Baylor College of Dentistry
TAC Americas, Inc.

On off campus locations and remote on campus locations, type of controls shall be as required in the Program of Requirements or as directed by FPC Project Manager. As a minimum these locations shall have a means for night, week-end and holiday set-back.
Guide Specification

Automatic Temperature Controls & Energy Management System

PART I General

1.1 The bidding and Construction Requirements and General Requirements apply to this work.

1.2 Furnish and install all temperature, pressure, and flow sensors, transmitters, relays, switches, wire, tubing, and conduit external to the DDC panels. Also furnish all pneumatic controls, operators, air supply with compressor, control valves, transducers and tubing to connect components. Submit for approval, appropriate product data cut-sheets for all material/components intended for use prior to beginning work.

1.3 Owner shall furnish Direct Digital Control (DDC) panels complete with all microprocessors, software, terminal strips, pneumatic transducers, relays, and regulated power supply with battery backup. Empty panel boxes will be furnished by the Owner for mounting by the Automatic Temperature Controls Contractor.

1.4 Owner shall furnish a Terminal Equipment Controller (TEC) and electronic inlet damper actuator(s) for installation on each VAV terminal box and fan coil unit by the box manufacturer. These DDC devices shall be delivered to the VAV box or fan coil unit manufacturer's factory in sufficient time for the manufacturer to meet their scheduled delivery obligations.

1.5 The box manufacturer shall provide for each box an inlet flow sensor(s) suitable for interfacing with a Honeywell micro bridge pressure transducer, any necessary pilot control relays, and factory mount and connect these devices and the DDC controller as required for proper operation as required under this section. The cost of factory mounting shall be included in the cost of the VAV boxes. All other wiring and terminations related to the DDC controller (TEC) shall be provided by the ATC contractor.

1.6 Room temperature sensors, room humidity sensors, and room sensor mounting base plates shall be provided by the Owner for installation by the ATC contractor.

1.7 Pneumatic temperature controls and non-DDC accessories that are standard catalog products as manufactured by Siemens Building...
Technologies, Inc., Johnson Controls, Inc., or Honeywell will be acceptable. Industrial instrumentation supplied shall be standard catalog products of Rosemount, Honeywell, Bristol, Foxboro, Leeds and Northrup, Taylor or Brown. All coordination and execution of work pertaining to the installation, service and guarantee, under this section of the specifications, shall be the sole responsibility of the Contractor.

1.8 All controls to be installed, calibrated and adjusted by trained instrument technicians in the full-time employ of the Automatic Temperature Controls Contractor. The ATC Contractor shall not subcontract this work in whole or in part to another contractor or individual(s).

1.9 The ATC Contractor shall be a factory-owned branch of the corporations listed in 1.10, below. Distributorships shall not be acceptable as ATC Contractors.

1.10 Acceptable ATC Contractors, provided they comply with these specifications, are:

a. Siemens Building Technologies, Inc.
b. Johnson Controls, Inc.
c. Honeywell, Inc.
d. TAC Americas, Inc.

1.11 Submit engineering/wiring drawings and receive approval prior to beginning work. These drawings shall be submitted in a timely manner to provide sufficient time to review drawings so as not to hold up the project.

1.12 The Owner-furnished DDC field panels will be located in mechanical rooms as shown on the drawings. All sensor and start/stop wiring will be brought back to the panel responsible for controlling/monitoring the mechanical/electrical equipment for which the sensor, start/stop wiring and tubing is directly related.

1.13 Division 26 shall provide power to a duplex receptacle inside each DDC panel. Power shall be provided from a breaker, 20 amp dedicated circuit having an insulated ground wire from the power panel ground buss wired to the duplex receptacle.

1.14 Furnish and install a network communications trunk (N.C.T.) between DDC panels, and a separate LAN communications network between each terminal unit controller (or group of controllers) back to the DDC panel associated with the AHU which serves the terminal units(2). Trunks shall be connected to the panels/controllers in a daisy-chain fashion, with no "T" connections permitted. In addition, the N.C.T. trunk shall be extended from the nearest Panel to an Owner-provided, dedicated line junction box.
1.15 The Owner shall provide the dedicated line between the junction box and the Campus Energy Management System, as well as program the panels with operational sequences and set-points specified.

1.16 Furnish, install and make connections of all interlock, power for sensors (if required), 24 volt, 40 va power source for each TEC, line and low-voltage wiring external to DDC panels. Wiring and tubing into panels shall require a minimum of 5 feet extra length with which the Owner will make final terminations inside the DDC panels. All wiring shall be clearly and permanently labeled as outlined in Section 1.17E below. Tubing will be labeled in a similar fashion as well.

1.17 Automatic Temperature Control/Engineering Management System wiring:

A. All wiring and conduit shall be installed in accordance with related Specification Section Division 16 Electrical.

B. The conduit/wiring system required for the ATC/Engineering Management System shall be a complete, separate, independent system. Conduit sharing with other unrelated electrical systems is not permitted. All control wiring shall be in conduit, 3/4 inch minimum.

C. Conduit fill limit shall not exceed 40 percent in any portion of the conduit system.

D. In order to facilitate maintenance, where multiple sensors or devices are connected to a common raceway or conduit, each sensor or device shall be individually connected to a common (non-sensor or device) junction box, which shall then be attached to the common conduit. Under no circumstances shall sensor or device wiring or tubing be routed through any other sensor or device's specific enclosure or junction box.

E. All wiring shall be labeled at both ends and at any spliced joint in between. Wire and tubing shall be tagged using 3M, ScotchCode WriteOn Wire Marker Tape Identification System; product number SWD-R-11954 with 3/4 inch x 5/16 inch write-on area or SLW 12177 with 1 inch x 3/4 inch write on area with 3M ScotchCode SMP Marking Pen. In addition to tagging at field device end and at spliced joints, a tag shall be placed 6 inches after entering each DDC panel. Identification and tag information shall be included in engineering/wiring submittal which must be submitted for Owner approval prior to beginning work. Tag information shall coincide with equipment/point information as written in the specification input/output summary.
F. Digital Input (D.I.) wiring (Class 2) may be run in a common conduit with Digital Output (D.O.) wiring (Class 1) where local codes permit.

G. Analog Input (A.I), Analog Output (A.O.), Digital Input (D.I.), and Network Communications Trunk (N.C.T.) wiring may be run in a common conduit.

H. Digital Output (D.O.) wiring run in a common conduit with Analog Input (A.I.), Analog Output (A.O.), or Network Communications Trunk (N.C.T.) is not permitted under any circumstances.

I. AC line power to DDC panel shall be No. 12 THHN.

J. Digital Output (D.O.) wiring shall be No. 14 THHN.

K. Digital Input (D.I.), Analog Input 4-20 mA (A.I), and Analog Output (A.O.) wiring shall be No. 18 TSP (twisted, shielded pair with drain wire, stranded).

L. Analog Input/Thermistor/or voltage types (A.I.) wiring shall be No. 18 TSP (twisted shielded pair with drain wire, stranded).

M. Network Communications Trunk (N.C.T.) between DDC panels shall be two (2) individual No. 24 awg TSP (twisted, shielded pair, stranded) cables, not to exceed 12 pf capacitance per foot, wire-to-wire. Terminal Unit controller LAN networks shall be one (1) No. 24 awg TSP of the same type.

N. Field devices requiring a 4-20 mA DC input signal shall be non-ground referenced.

1.18 System Verification--Procedure to be followed:

A. Upon completion of all external sensor mounting, terminations, and wiring/air-piping into and out of the DDC panels, the Owner shall inspect and approved this work. The ATC Contractor shall make his Representative(s) available and coordinate with the Owner during this inspection process.

B. Upon such approval being achieved, the Owner shall make terminations within the DDC panels.

C. Following completion of the work and the Owner's DDC panel tie-in, a performance test shall be conducted by the Owner in the presence of the ATC Contractor. The ATC Contractor's representative shall be
present at all times during the point-to-point checkout of the work, to quickly correct any wiring, tubing, and/or end device problems which may be uncovered during system startup.

D. Upon conclusion of final checkout and acceptance, the Contractor's responsibility reverts to warranty of materials and installation herein specified. System shall be warranted for a period of two (2) years.

1.19 Coordination of Effort: It is the responsibility of the Contractor to schedule and coordinate with the installer of owner furnished equipment. The ATC Contractor shall notify the Owner's DDC representative in writing when each panel or section of work is complete and ready for startup. Sufficient notice shall be given as described below. If any deficiencies are subsequently encountered by the Owner's DDC representative, the Owner's DDC representative, in order to expedite the progress of the project, may at his option, either correct the deficiency, or notify the ATC Contractor of the deficiency. Any costs incurred by the Owner's DDC representative due to having to correct any deficiency, or due to delays or multiple trips to the project site, shall be billed to the Owner, and forwarded to the ATC Contractor.

A. The Contractor shall schedule his construction activities so that all his work is verified and completed in due time to allow for the owner to install the DDC panels, make terminations, and prove the system. A minimum of 8 working days per panel shall be allowed in the project schedule for this purpose.

B. Coordination of activities is the responsibility of the Contractor. The Owners installer shall be notified a minimum of 7 days prior to the completion of Contractor work at the DDC box.

C. It is the Contractor's responsibility to schedule the accomplishment of these activities to allow for nominal system checkout, performance tests and balancing within the contract performance period.

1.20 Input/Output Summary: The following I/O Summary is provided as a summary of the minimum points required by this contract for connection to the Owner's Energy Management system. Furnish all devices, wiring, tubing, etc., necessary to serve and transmit to the Owner's panels. Any points not shown on the I/O Summary yet required to accomplish the sequence of operation shall be provided under this contract at no additional cost to the Owner.

[A/E SHALL INCLUDE AN INPUT/OUTPUT SUMMARY FOR THE PROJECT. (SAMPLE ATTACHED). THE FOLLOWING SCHEDULE IS REPRESENTATIVE OF THE POINTS TO BE MONITORED AND CONTROLLED AND WILL BE USED AS A GUIDE FOR PREPARING
THE SUMMARY

A. Temperature Monitoring:

1. Outside Air.
2. Return Air.
3. Mixed Air.
4. Discharge Air Each Single Zone Unit.
5. Cold Deck Each Multizone Unit.
6. Hot Deck Each Multizone Unit.
7. Multizone unit--supply air temperature each zone.
8. Space Temperature of each Multizone Thermostat.
11. Domestic Hot Water Supply from Central Plant.

B. Humidity Monitoring:

1. As required and as directed by Owner.

C. Start/Stop Functions (Differential Pressure):

1. Each Hot Water Pump.
2. Each Chilled Water Pump.
3. Each Air Handling Unit.
4. Each Domestic Hot Water Pump (as directed by owner).

D. Flow Monitoring (GPM):

1. Chilled Water Supply from Central Plant.
2. Hot Water Supply from Central Plant.
3. Domestic Hot Water Supply and return from Central Plant (as directed by owner).

E. Pressure Monitoring:

1. Duct Static Pressure of Each VAV System.
2. Chilled Water Supply and Return from Central Plant.
3. Heating Water Supply and Return from Central Plant.
4. Domestic Hot Water Supply from Central Plant (as directed by owner).
5. Differential Pressure across air filters (major units only).

F. Miscellaneous Monitoring:

1. Total Building Electrical (Volt, Amps, KW).
2. Electrical Usage (KW) of Each Motor (chilled water pumps, heat pumps, domestic hot water pumps, air handling unit (25 HP or larger).

PART 2 Products

2.01 FIELD DEVICES

A. Temperature Sensors: Platinum Resistance Temperature Detector, 0 degrees F to 400 degrees F range, 100 ohms at 0 degrees C, 316 stainless steel sheath, single element, 1/4 inch diameter sheath. For water sensing provide 316 stainless steel thermowells. Use 304 stainless steel extension fitting to extend assemblies through insulating materials. Spring-loaded sensors to ensure good surface contact in thermowells. Accuracy of + / - 0.1 degrees F from 20 degrees F to 70 degrees F for chilled water monitoring, accuracy of + / - 0.5 degrees F from 30 degrees F to 250 degrees F for condenser water, hot water, or domestic water monitoring, and accuracy of + / - 0.5 degrees F from 20 degrees F to 120 degrees F for all other temperature monitoring. Install on chilled water lines such that condensation does not collect in connection head. Duct temperature sensors shall be averaging type. Water sensors shall be provided with a separable stainless steel well. Outside air wall mounted sensors shall be provided with a sun shield. Accuracy of transmitter shall be unaffected by wiring distances up to 700 feet. Siemens Building Technologies, Inc., Minco, Hy-Cal only.

B. Room Sensors:

1. Each room temperature sensor shall come complete with a terminal jack and override switch integral to the sensor assembly. The terminal jack shall be used to connect the portable operator's terminal to control and monitor all hardware and software point associated with the terminal unit.

2. An override switch will initiate override of the night setback or unoccupied mode to normal (day) operation when activated by the occupant. The switch function may be locked out, canceled or limited as to time or temperature in software by an authorized operator or a central or remote operator's terminal.

3. Space temperature sensors may be Thermistor or 4-20 mA output RTD. The room sensor shall be firmly attached to the wall using approved construction techniques. Double-sided adhesive tape in lieu of screws is not acceptable.

4. The room sensor shall be accurate to within + / - 0.5 degrees F (+ / -
.3 degrees C) and have a set point adjustment range of 45 degrees to 85 degrees (5 degrees to 30 degrees C).

5. Room sensors shall be blank cover in all areas.


C. Flow Sensors: Flow sensors shall be constructed of stainless steel with no moving parts introduced into the flow medium. The sensor shall be a multiple tube, rigid structure that provides dual-averaging chambers with a diamond-shaped cross section. Each sensor shall be sized specifically for the pipe or elliptical in which it is to be installed, and shall be provided with individual flow calculation sheets stating so. Provide the proper instrument valve connections so that the differential pressure-sensing equipment can be removed while the system is pressurized. Instrument valve and tubing shall be stainless steel. Flow sensors shall be Dieterich Standard Annubar Model DMT PRESO or equal, installed in accordance with manufacturer's recommendations for an accuracy of +/ - 1.05 percent of flow. Venturi or orifice flow sensing devices may be used for special applications.

D. Temperature Transmitters: Temperature transmitters shall be designed for 4-20 mA DC output for Platinum RTD millivolt input sensor (as specified in Paragraph 2.1 above). Accuracy and range shall be the same as specified for the temperature sensors. Stability shall be +/ - 0.2 percent of calibrated span for 6 months. Transmitter shall be a part of the temperature sensor assembly and shall be in a moisture-proof housing with a moisture-proof seal between the sensor and transmitter. Siemens Building Technologies, Inc., Minco, or Hy-Cal only.

E. Water Flow Transmitters: Flow transmitters shall provide a 4-20 mA DC signal output proportional to flow. Accuracy of +/ - 0.25 percent of calibrated span. Temperature Limits: -40 degrees F to +220 degrees F. Stability of +/ - 0.25 percent of upper range limit for 6 months. Range of transmitter shall be individually calibrated to match each flow meter's flow conditions, and shall be provided with individual flow calculation sheets stating so. Flow transmitters shall be Rosemont, Foxboro or Gould, only.

F. Pressure Transmitters: Transmitters for water flow and pressure shall provide a 4-20 mA DC signal output directly proportional to pressure. Accuracy of +/ - 0.5 percent of calibrated span. Span not over 200 percent of sensed pressure. Stability +/ - 0.5 percent of upper range limit for 6 months. Stainless steel diaphragm, viton 0-rings. Temperature limits: -20 degrees F to 220 degrees F. Rosemount, Setra,
G. Fan proof-of-flow switches shall be UL listed adjustable setpoint and differential pressure type. Switches shall be piped to fan discharge except where fans operate at less than one inch WG, they shall be piped across the fan. For fractional horse power and non-ducted fans, relays or auxiliary contacts may be used. Maximum pressure rating shall be at least 10 inches WC.

H. Pump proof-of-flow switches shall be UL listed adjustable differential pressure or flow type as specified in the sequence of operation or data point summary. Devices shall be 150 psi rated except chilled water flow switches shall be provided with totally sealed vapor tight switch enclosure on 150 psi body. Differential pressure switches shall have valved manifold for servicing. Current monitor relays, properly sized for the associated load and having an adjustable switching set point, may be used in lieu of pressure switches on pumps; Hawkeye or equivalent.

I. Air flow and static pressure analog transmitters shall be high accuracy suitable for the low velocity pressures to be encountered, be selected for approximately 50 percent over-range, and have an electronic 4 to 20 mA analog output. Transmitters shall have an accuracy of ±0.5 percent of calibrated span. These differential pressure sensors shall be connected to the air flow measuring station (where applicable) with valved lines for testing and calibration, and shall have adjustments for zero and span. Rosemount, Dresser Industries/Ashcroft XLDP or Setra C-264, only.

J. Flow Switches shall be packless construction with all wetted parts made of brass and designed for mounting in pipe sensing wells. Device shall be capable of being mounted in pipe sensing wells 1 inch and larger. Paddle shall be provided with removable segments to accommodate required pipe size and flow. Switching action shall be single-pole, double-throw with a rating of 7.4 amps full load with 115 volts AC.

K. Electric Low Limit Duct Thermostat: Snap-acting, two pole, single throw, manual reset switch which trips if temperature sensed across any 12 inches of bulb length is equal to or below set point, requiring minimum 15 feet length of bulb. Provide one thermostat for every 20 square feet of coil surface.

L. Air Flow Measurement Station: Averaging "pitot" array per ASHRAE traversing guidelines, utilizing integral flow straighteners. Brandt Instruments B-DSK9000, Air Monitor FAN-E, or equivalent. The
AFMS shall have total static pressure sensors for sensing multiple velocity pressures in the air stream profile.

M. Carbon Dioxide Sensor: C02 sensor shall be Horiba model number APBA-250E or approved equal. The unit shall be self contained for wall mounting application. The unit shall have a small pump for sampling point and fast response and shall have 0-1 percent range corresponding to an isolated 4-20 mA output. Visual alarm is not to be provided. The monitor shall utilize the non-dispersive infrared (NDIR) method.

N. Humidity Sensor: Sensor shall provide a 0 to 100 percent range corresponding to an isolated 4 to 20 MA output. Accuracy of + / - 2 percent RH, with maximum drift of 1 percent per year.

O. Static outside air probe shall be utilized where outdoor static pressures are to be measured. Provide a probe by Air Monitor, S. O. A. P., or approved equal. Probe shall be constructed of 10 gauge anodized aluminum with a 2 inch diameter FPT connection. The probe shall have a + / - 2 percent accuracy when subject to radial wind velocities of up to 80 miles per hour with approach angles up to 30 degrees to the horizontal.

P. Electric Room Thermostats: Provide line voltage room thermostats with cover. Set point must be adjustable from approximately 50 to 100 Deg. F. Minimum rating is 6 amps at 120 vac. Provide removable setting knob. Housings shall not contain thermometers.

Q. TEMPERATURE CONTROL VALVES

1. Valves shall be two way. Valves 2 inches and smaller shall have screwed bronze or brass bodies. Valves 2-1/2 inches or larger shall have flanged iron bodies. The assembled valves shall be rated for ANSI Class 125 operating pressure. All valves shall be sized for full flow and with a maximum pressure drop of 5 psi unless specified otherwise hereinafter. All straight through water valves shall have modified equal percentage flow characteristics. Valves shall close off against the full head of the system pumps.

2. Provide control valves with a chart indicating the valve constant (CV) rating of all valves referenced to the drawings so that the valve pressure drop may be used for balancing and performance tests.

3. Pneumatic valve operators shall have replaceable neoprene diaphragms, stainless steel stem, adjustable spring, replaceable EPT disk, shall be spring loaded, self adjusting packing. Actuator shall have metal housing. Operating temperature range shall be 25
to 300 degree F. Valves which are used in sequence with another on the same pneumatic signal shall be provided with positive positioners.

R. BUTTERFLY VALVE ACTUATORS

1. Butterfly valves shall be straight-through type, as described elsewhere. Operators shall be capable of receiving 60-80 psi air signal for on/off service and for modulating service shall be equipped with a positioner capable of receiving 3-15 psi air signal and transmitting 60-80 psi signal to operator. Valves shall be suitable for 150 psi bubble tight shut-off. Valve construction shall be as specified elsewhere. Valves shall be available with field interchangeable powered actuators. The actuator-to-shaft connection shall be designed to shear and prevent internal valve damage if the disc closes on foreign material in the pipeline. All actuators shall provide external indication of disc position.

2. All units to have adjustable open and close position stops with provision to prevent accidental changes. Operating shaft to be supported axially and radially at input end by permanently lubricated bronze thrust and sleeve bearings.

3. Cylinder actuators shall have gear actuator in weatherproof enclosure with integral double-acting pneumatic cylinder sized for maximum differential of 150 psi working mechanism fully enclosed, and shall be sized for operations using 80 psi pneumatic supply. Cylinder actuators to be furnished with pilot valves, Bailey-type positioners, limit switches, manual override, speed control valves. All units shall have adjustable open position stops. Damper-motor-type actuators shall not be acceptable for butterfly valve actuation.

S. PNEUMATIC DAMPER ACTUATORS

Pneumatic damper actuators shall be of the piston type equal to Landis and Staefa AP 331 Series actuator. Actuators of plastic will not be acceptable.

T. AIR FLOW CONTROL DAMPERS

1. The Temperature Control Contractor shall provide all control dampers of the type indicated on the plans. Frames shall not be less than 13 gauge galvanized steel. Blades must not be over 8 inches wide nor less that 16 gauge galvanized steel roll formed. Bearings shall be oilite, ball bearing or nylon with 1/2 inch shafts. Side seals shall be stainless steel of the tight-seal spring type.
Dampers and seals shall be suitable for temperature ranges of -40 degrees F to 200 degrees F.

2. All proportional (modulating) control dampers shall be opposed blade type and all two-position dampers shall be parallel-blade types.

3. Dampers shall be minimum leakage type to conserve energy and the manufacturer shall submit leakage and flow characteristic data for all control dampers with the temperature control submitted. Maximum leakage shall be 3 percent at static pressure of 3 inches of WC.

U. CONTROL AIR SUPPLY

1. Provide two air compressors each sized for maximum running time of 33 percent at 80 psi with automatic alternator for temperature control usage, and one compressed air drier.

Both compressors shall be mounted on a single storage tank of sufficient size to insure not more than six compressor operations per hour. Tank shall conform to the ASME Code for non-fired pressure vessels and so stamped. Each compressor shall be equipped with a pressure intake filter, outlet filter, belt guards and automatic trap and drain for each tank. The compressor motors shall be suitable for operation on 460 AC, 3-phase, 60 Hertz. Furnish an Allen-Bradley, or approved equal, automatic electric alternator for the units which will operate first one compressor and then the other, but will operate both compressors in the event air pressure fall too low. Provide override switch to omit alternator and allow either compressor to operate individually in the event one compressor is inoperable. Control voltage shall be 120 volts AC.

2. Compressed Air Drier shall be Ingersoll-Rand, Zeks, or approved equal, refrigerated moisture condenser. The air piping from each compressor duplex unit shall be so piped that air from either compressor will pass through the drier. The moisture condenser shall come with a wall bracket and automatic trap. The condenser shall be sized to maintain a 10 degree F dewpoint of the air supply to the system.

3. Main Air Pressure Reducing Stations: Provide a combination sub-micron filter-pressure reducing station. The filter shall be capable of the removal of entrained oil and shall be rated for 97 percent efficiency at rated air flow. Air reducing valve shall be sized for quantity of air required and be capable of reducing air supply form
60 psi to control air pressure. The entire air supply at the air compressor shall be piped in parallel to permit shut down of a compressor without feedback in any part of the system which has been shut down. Provide high pressure main air to each DDC panel location, with PRV to serve DDC pneumatic transducers (one PRV per DDC panel location). Provide 2 inch diameter air pressure gauges upstream and downstream of reducing station.

V. PNEUMATIC INSTALLATION

The pneumatic portion of the temperature control system shall be installed by men regularly employed by the ATC Contractor. User of subcontractors by the ATC Contractor shall be unacceptable. Pneumatic piping shall be concealed wherever practical. Hard-drawn copper tubing or poly encased in raceway is to be used for all areas. Copper tubing shall be installed in neat and workmanlike manner and shall be as inconspicuous as possible. Bulkhead fittings shall be utilized for all penetrations through enclosures, raceways, and the like. Poly tubing, where employed as flexible connections within hard copper runs, shall be limited in length to 6 inches. The entire system shall be tested under applicable operating air pressure for a period of twenty-four (24) hours during which the pressure drop shall not exceed 2 psig.

PART 3 Execution

2.01 SEQUENCE OF OPERATION

[A/E TO INCLUDE CONTROL SEQUENCE OF OPERATION]

Refer to the I/O Summary for any additional points required.
Guide Specification for TAMU Projects

Automatic Temperature Controls & Energy Management System

PART I General

A. The bidding and Contract Requirements and General Requirements apply to this work.

B. Furnish and install all components but not limited to all temperature, pressure and flow sensors, transmitters, relays, switches, wire and conduit external to the DDC panels. Also furnish all controls, operators, power supplies, control valves, air and water flow measuring stations, transducers and wiring to connect components. Submit for approval, appropriate product data cut sheets for all material/components intended for use prior to beginning work. Where EMS is used in specification and drawings, it is understood to be same as DDC. In addition, provide a complete installation of the owner furnished Siemens DDC System. In addition, install the owner furnished Siemens Laboratory Control System (LCS).

C. Owner shall furnish all Siemens Direct Digital Control (DDC) panels with all microprocessors, software, terminal strips, transducers, relays, and regulated power supply with battery backup. Empty panel boxes will be furnished by the Owner for mounting by the Automatic Temperature Controls Subcontractor.

D. Owner shall furnish a Siemens HVAC Terminal Equipment Controller (TEC), electronic damper actuator(s), and electronic HW valve’s and actuator’s for installation on each VAV terminal unit and fan coil unit, as applicable, by the terminal equipment manufacturer. These DDC devices shall be delivered to the manufacturer's factory in sufficient time for the equipment manufacturer to meet their scheduled delivery obligations. Owner shall furnish all Siemens DDC lab control system components, including TECs, Lab Supply Air Terminal Units with reheat coils (duct mounted), General Air Fume Hood Exhaust Terminals, and all other associated controls components. Installation of all air terminals shall be by the mechanical contractor.

E. The terminal equipment manufacturer shall provide for each VAV box an inlet flow sensor suitable for interfacing with the Siemens TEC. For VAV boxes and all other terminal equipment (fan coil units, etc.) a 24 vac, 40 va transformer, any necessary pilot control relays will be provided by the ATC, and installed by the ATC, and connect these devices to the DDC controller as required for proper operation as required under this section. The cost of factory mounting shall be included in the cost of the terminal equipment. All other wiring and terminations related to the DDC controller (TEC) shall be provided by the ATC contractor. All other wiring and terminations related to the lab control system components shall be provided by the ATC contractor.
G. The ATC Contractor shall provide for each TEC, a 24 vac 40 va power source, and mount and connect these devices and the DDC controller as required for proper operation as required under this section. All other wiring and terminations related to the TEC shall be provided by the ATC contractor.

H. Room temperature sensors, CO₂ sensors, and sensor and humidity mounting plates shall be provided by the Owner for Installation by the ATC contractor. Terminal Unit Control Valves provided by Owner will be installed by Mechanical Contractor. Humidity sensors provided by Owner will be installed by ATC Contractor.

I. Temperature controls and non-DDC accessories that are standard catalog products as manufactured by Siemens Building Technologies, Inc., Johnson Controls, Inc., or Honeywell will be acceptable. Industrial instrumentation supplied shall be standard catalog products of Rosemount, Honeywell, Bristol, Foxboro, Leeds and Northrup, Taylor or Brown. All coordination and execution of work pertaining to the installation, service, and guarantee, under this section of the specifications, shall be the sole responsibility of the ATC.

J. All controls to be installed, calibrated and adjusted by trained instrument technicians in the full-time employ of the Automatic Temperature Controls Subcontractor.

K. Mechanical contractor shall not serve as ATC contractor. Acceptable ATC contractors, provided they comply with these specifications are:
   1. Siemens Building Technologies, Inc.
   2. Johnson Controls, Inc.
   3. TAC Control Systems.
   4. No exceptions

L. Submit engineering/wiring drawings receive approval prior to beginning work. These drawings shall be submitted in a timely manner provide sufficient time to review drawings so as not to hold up the project.

M. The Owner-furnished DDC field panels will be located in mechanical rooms as shown on the drawings. All sensor and start/stop wiring will be brought back to the panel responsible for controlling / monitoring the mechanical / electrical equipment for which the sensor, start/stop wiring is directly related. The location of the panels may not be shown on the drawings. Locate Laboratory Control Panels as indicated on drawings.

N. Division 26 shall provide emergency power to a duplex receptacle inside each panel. Emergency power shall be provided from a breakered, 20 amp dedicated circuit having an insulated ground wire from the power panel ground buss wired
to the duplex receptacle.

O. Furnish and install a dedicated Ethernet cabling network for the DDC system, all exposed wiring shall be in conduit, as per division 26 specifications. Concealed wiring shall be plenum rated. All active Ethernet switches, hubs, and routers shall be Owner-provided and installed (by Siemens).

Furnish, install and terminate individual Cat-6 cable assemblies to interconnect each mechanical room in a star configuration. A star configuration is designed with each main building panel connected directly to a network switch. Data is passed through the switch before continuing to its destination to other main building panels and to the front end. Each cable shall originate and terminate within one designated DDC panel in each mechanical room, as shown on the plans. Additionally, furnish, install and terminate individual Cat-6 cable assemblies to connect each DDC panel within the mechanical room(s) with the others in that same room, in a star configuration.

Each cable assembly shall originate and terminater within the DDC panel enclosure(s), with 5 feet of extra length at each end, so that no spicing, jumpers or extensions are required to complete the network between panels. Each cable shall be clearly labeled, identifying the DDC panel of origin, and the DDC panel to which it is to be connected.

All cable runs between mechanical rooms and/or DDC panels shall be no longer than allowed as specified in section 16700. Where runs are required that will be longer than section 27 allow, furnish and install an additional enclosure near the midpoint (coordinate location with architect), to be used as a network junction box, complete with a 120 VAC emergency power source. Terminate and label the cables within this junction box as directed for each DDC panel.

Refer to section 27 specifications for complete network cable specifications. Furnish and install a network communications trunk (N.C.T.) between DDC panels, and a separate LAN communications network between each terminal equipment controller (or group of controllers) back to the DDC panel associated with the AHU which serves the terminal unit (or lab-trac system). Trunks shall be connected to the panels/controllers in a daisy-chain fashion, with no “T” connections permitted. A maximum of 32 TECs per LAN trunk shall be permitted.

P. Furnish, install and make connections of all Interlock, power for sensors (if required), line and low-voltage wiring external to DDC panels. Wiring into panels shall require a minimum of 5 feet extra length which the Owner will make final terminations inside the DDC panels. All wiring shall be clearly and permanently labeled as outlined below.

Q. The ATC Contractor shall provide a dedicated line between the junction box and the Campus (University) Energy Management System, as well as program the
panels with operational sequences and set-points specified.

1.02 SUBMITTALS:

A. Manufacturer’s Product Data: All equipment components

B. Shop Drawings:
   1. System wiring diagrams with sequence of operation for each system as specified.
   2. Submit manufacturer’s product information on all hardware items along with descriptive literature for all software programs to show compliance with specifications.
   3. System configuration diagram showing all panel types and locations as well as communication network and workstations.

1.03 AUTOMATIC TEMPERATURE CONTROL / ENGINEERING MANAGEMENT SYSTEM WIRING:

A. All wiring and conduit shall be installed in accordance with related Specification Section Division 26 Electrical.

B. The conduit / wiring system required for the ATC/Energy specification Input/Out summary.

C. Digital Input (D.I.) wiring (Class 2) may be run in a common conduit with Digital Output (D.O.) wiring (Class1) where local codes permit.

D. Analog Input (A.I.), Analog Output (A.O.), Digital Input (D.I.), and Network Communications Trunk (N.C.T.) wiring may be run in a common conduit.

E. Digital Output (D.O.) wiring run in a common conduit with Analog Input (A.I.), Analog Output (A.O.), is not permitted under any circumstances.

F. AC line power to DDC panel shall be #12 THHN.

G. Digital Output (D.O.) wiring shall be #14 THHN.

H. Digital Input (D.I.), Analog Input 4-20 mA (A.I.), Analog Output (A.O.) wiring shall be #20 TSP (twisted shielded stranded pair with drain wire).

I. Analog Input/Thermistor/or voltage types (A.I.) wiring shall be #20 TSP (twisted shielded stranded pair with drain wire).

J. Field devices requiring 4-20 mA DC input signal shall be non-ground referenced.

1.04 SYSTEM VERIFICATION—PROCEDURE TO BE FOLLOWED:
A. Provide minimum 2 week written notice for all inspections.

B. The system verification also includes the Laboratory Control System.

C. Upon completion of all external sensor mounting, terminations, and wiring into and out of the DDC panels, the Owner shall inspect and approve this work. The ATC Subcontractor shall make his Representative(s) available and coordinate with the Owner during this inspection process. At the successful conclusion of this inspection, contractor shall provide a written report stating all work is complete. ATC Subcontractor, General Contractor and Owner’s Rep shall sign. This should be filed with Project Commissioning/Startup documents.

D. Upon such approval being achieved, the Owners representative shall make terminations within the DDC panels.

E. Following completion of the work and the Owner’s DDC panel tie-in, a performance test shall be conducted by the Owner in the presence of the Contractor and his appropriate Subcontractors.

F. The ATC shall be present for the testing of proper operation of each and every physical system point to which the ATC has provided devices, wiring, in order to verify the equipment and installation provided by them (their portion of the work), i.e., when the Owners representative commands a point, the ATC verifies in the field that the commanded point operates properly. At the successful conclusion of this inspection, contractor shall provide a written report stating all work is complete, calibrated and functioning property per the specified sequences of operation. ATC Subcontractor, General Contractor and Owner’s Rep shall sign. This should be filed with Project Commissioning/Startup documents.

G. Owner’s representatives shall attend initial inspection and verification of completed punch list of items in paragraphs C. and F. of this section. Further inspections required due to incomplete/incorrect work shall be at ATC expense.

H. Upon conclusion of final checkout and acceptance, the ATC responsibility reverts to warranty of materials and installation herein specified. System shall be warranted for a period of two (2) years.

1.05 COORDINATION OF EFFORT:

A. It is the responsibility of the ATC to schedule and coordinate with the installer of owner furnished equipment.

B. The ATC shall schedule his construction activities so that all his work is verified and completed in due time to allow for the Owners representative to install electronic components in the DDC panels, make terminations, and prove the
system. A minimum of 8 working days per panel shall be allowed in the project schedule for this purpose.

C. Coordination of activities is the responsibility of the ATC. The Owners installer shall be notified a minimum of 7 days prior to the completion of the ATC work at the DDC can.

D. It is the ATC responsibility to schedule the accomplishment of these activities to allow for nominal system checkout, performance tests and balancing within the contract performance period.

The ATC shall notify the Owners representative in writing when each panel or section of work is complete and ready for startup, meaning that fans are ready to run, VFD's have been started up, CHW is available, all devices are functional, power is on to all devices and panels, etc.

Sufficient notice shall be given as described above.

E. If any deficiencies are subsequently encountered by the Owners representative in work identified in writing by the ATC as complete and ready for startup, in order to expedite the progress of the project, the Owners representative may, at their option, either correct the deficiency, or notify the ATC of the deficiency and have them correct it. Any costs incurred by the Owners representative due to having to correct any deficiency, or due to delays or multiple trips to the project site, shall be billed to the ATC.

**Metering**

All projects shall have all utilities metered and remotely monitored by Utilities and Energy Management. The metering shall be accomplished by the following:

1. The electrical contractor shall furnish and install at least one (1) Square D ‘Powerlogic” model #3250 electric meter at the electrical service entrance for each building that will read the entire building electrical load. Double ended substations or additional services entrances shall require an additional model #3250 meter.

2. The electrical contractor shall furnish and install additional Square D meters as required for sub-metering electric loads as required to meet LEED verification requirements. These meters can be “Power Meters”, “Intercept Meters” or similar four wire digital meters manufactured by Square D that can be networked with the main “PowerLogic” meter(s). If auxiliary enterprise areas are included in the building, those areas shall have the electrical load isolated and measured by a revenue quality Square D four wire digital meter. All meters shall have a local display.

3. The electrical contractor shall provide and install all interconnect wiring to all meters regardless of their location. All wiring shall meet Square D standards for type,
length, installation and connection.

4. The electrical contractor shall furnish and install an EGX-400 internet interface module mounted in its own enclosure mounted on a wall inside the main electrical room. This module shall be connected to emergency power (if a generator is included in the design) and to a category 6 data connection served from the nearest data/telecom room.

5. The electrical contractor shall furnish and install a Square D “WAGES” (Water, Air, Gas, Electric, Steam) box that is to be mounted in the building pump room. All inputs listed in the points list related to metering a utility (except electric) shall be routed to the WAGES box by the ATC using appropriate cables and left labeled but unterminated. The ATC shall also install an additional set of cables from the WAGES box to the Siemens main DDC enclosure for termination.

6. Prior to energizing the main electric switchgear the contractor shall schedule and pay a Square D technician to commission the main electric meter(s) and all other meters located in the main switchgear. This commissioning will include a complete setup of the meter(s), termination of all meter interconnecting cables located in the main switchgear, entering all required security codes and flags as directed by the Utilities and Energy Management and verification that the meter(s) are reading correctly.

7. Prior to any Substantial Completion the contractor must arrange and pay for a second commissioning trip from Square D to complete all connections to the Square D meters, all connections to the WAGES box and verify proper operation of both systems. This verification shall include the modification of the head end equipment located at the Energy Office. Data connections must be installed and functional so that Square D can verify the communication between the project meters and the Energy Office. This commissioning may require multiple days and multiple trips from Square D.
This section is currently being revised. Contact Joe Ellerbrock, 979.458.7041, jellerbrock@tamus.edu, or Bruce Karr, 979.458.7042, bkarr@tamus.edu, for the latest version.
General Information

Telecommunications Facilities

The following paragraphs set forth the general telecommunications systems' design criteria for a campus major building. Adjustments will be necessary to meet the needs of lesser size buildings and special function buildings. Verify all special telecommunications (telephone and computer) requirements through the FPC Project Manager.

Telecom Equipment Rooms

Telecom Equipment rooms shall comply with the following requirements:

Comply with Telecommunications Industry Association/Electronics Industry Association (TIA/EIA) Telecommunications Building Wiring Standards in every respect.

Minimum telecom room size. 10' x 9' - Reference: TIA/EIA 569 Table 7.2-1. A/E size the Main Distribution Frame (MDF) room according to TIA/EIA for the services to be located in this room. Provide a scaled layout of this room at the Preliminary Design review.

MDF and Intermediate Distribution Frame (IDF) closets should be designed to accommodate a minimum of 50% increase in used rack space beyond the final building requirements.

All walls to have 8 ft. covering of A/C plywood painted front and back with off-white or light grey fire retardant paint.

As stated in TIA/EIA 568A Section 4.3, the maximum horizontal run for Category 6 cable shall be 270 feet as measured from the punch down block in the telecom room to the most distant outlet in the work area. The 25-foot length below the 295 feet maximum length specified by TIA/EIA 568A, Section 4.3 accounts for the twist in the conductor pairs.

Provide a minimum of one quadruplex (double-duplex or “quad”) isolated-ground 120V power outlet on each wall with a maximum of two quad outlets per circuit. These circuits are to be dedicated to the telecom room and are not allowed to serve any other load.

Provide one 30A, 120V outlet (NEMA L5-30R) inside each telecom room (two in the MDF room) and Owner designated server rooms to serve an owner furnished and installed UPS.

Provide the ground bus required by TIA/EIA-607.
Provide 8’ x 19” racks and patch panels as appropriate to serve this building.

All telecom room walls must stack exactly with the telecom room located on the floor above and below it.

Telecom rooms shall not serve outlets on other floors except as necessary for under floor outlets that are not practical to run to the same floor telecom room. No open through hole penetrations are allowed to be made from conditioned space to unconditioned space (Example: outlets in the floor or in the wall where the cable drops down from a conduit stub into a cable tray in a basement crawl space.

No ceiling permitted in this room.

No means of liquid conveyance (water lines, sanitary or roof drain pipes, thermal, water, etc.) may pass through electrical or telecom rooms. Exception: Sprinklers may be installed telecom rooms as required by NFPA Code.

Do not locate a fan powered box in any of electrical or telecom rooms. Telecom rooms shall be air conditioned.

Do not locate ductwork or plumbing clean outs in electrical or telecom rooms.

No crawl space access from electrical or telecom rooms.

Do not install cable trays above light fixtures.

Supply the air-conditioning system for telecom rooms from emergency power if network-attached devices in the building will be provided with emergency power.

**Building Telecommunications Entrance Facilities:**

Provide a minimum of four, 4-inch Schedule 40 PVC conduits between the building primary telecommunications terminal room and the telecommunications manhole, tunnel, or other service point as designated by FPC Project Manager and Member Facilities Department. Maximum bending radius for the 4-inch conduits shall be 36 inches.

Ductbanks: Provide steel-reinforced concrete-encased underground pathways (ductbanks) for telecommunications cables between pull and splice points on the site and the building entrance facilities. Install a minimum of four 4” conduits in each ductbank plus spares as requested by the User. Construct communications ductbanks the same as medium-voltage ductbanks except that the concrete shall not be colored. Refer to Division 26, Electrical, for medium-voltage ductbank requirements.

Communications Manholes and Handholes: Provide precast concrete manholes and
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handholes for underground telecommunications outside the building. Provide manholes with nominal inside dimensions of 6'-0" wide X 12'-0" long X 7'-0" high for cable splicing purposes. Provide handholes with minimum nominal dimensions of 3'-0" wide X 5'-0" long X 3'-0" high for pulling purposes. Place handholes to not exceed cable manufacturer’s pulling tension by a safety factor of 2 and to limit horizontal and vertical bends to no more than 180 degrees between pulls.

Building Primary Terminal Room Facilities:

Provide a building primary telecommunications terminal room MDF sized in accordance with TIA/EIA 569 to terminate telecommunications entrance cables. This room shall house all fiber and copper service entrance equipment for the telephone, data and cable television distribution system, and all necessary wide area network equipment. Transformers, sound equipment, etc. that may generate objectionable electromagnetic radiation shall not be located in or adjacent to this room. As a minimum provide the following in this room.

Install on all walls an 8 ft. covering of grade “AC” plywood painted front and back with off-white or light grey fire retardant paint.

Provide a minimum of one quad isolated ground 20A, 120V power outlet on each wall with a maximum of two quad outlets per 20A circuit. These circuits are to be dedicated to the telecom room and are not allowed to serve any other load.

Ground resistance of the telecommunications grounding system shall not exceed 2 ohms and not more than the equipment manufacturer’s requirements.

Additional telecom room provisions:

- Lighting: 30 footcandles minimum.
- Place HVAC on a separate VAV box with no heating water coil.
- Provide telecom racks and patch panels as required.
- Provide line protectors for outside plant telephone cables.
- Provide two 30A, 208V outlet for future UPS.
- Provide the required number of 20A, 120V duplex receptacles mounted to the base of each equipment rack.
- Provide a termination point for a telephone and fiber riser cables to each floor.
- Provide an emergency power panelboard for this room dedicated to telecommunications equipment.

Floor/Zone Terminal Closet Facilities:

Provide a minimum of one telecommunications terminal closet per floor sized in accordance with TIA/EIA-569 to terminate telecommunications building distribution cables. As a minimum, provide the following in each closet:
Install on all walls an 8 ft. covering of A/C plywood painted front and back with off-white or light grey fire retardant paint.

Provide a minimum of one quad isolated ground 20A, 120V power outlet on each wall with a maximum of two quad outlets per 20A circuit. These circuits are to be dedicated to the telecom room and are not allowed to serve any other load.

Provide a minimum of four, 4-inch conduit sleeves to terminal room and other closets for both data and telecommunications cables. Minimum conduit bending radius shall be 30 inches.

Additional terminal closet provisions:

- Termination point for station cable distribution facilities from each telecommunications outlet served by a particular floor/zone closet.
- Illumination level average, 30 footcandles.
- HVAC as required.
- Provide telecommunications racks and patch panels as required.
- One 30A, 120V outlet for future UPS.

Locate terminal closets so that the physical wiring distance does not exceed 270 feet (not tested feet) to the most remote outlet.

Stack all terminal closets vertically. Provide 12-strand single mode (SM) fiber optic backbone cable between MDF room and all IDF rooms in a star configuration.

**Station Telecommunications Cable Distribution Facilities:**

Provide overhead cable tray raceway (or equivalent) from each floor/zone closet as the distribution backbone for all station outlets being served by a particular closet. Provide a 1" EMT conduit (not to exceed 100 feet length) between the serving raceway and each station outlet box. Telephone power poles, if used, shall be connected to the serving raceway in a similar manner. Dress in the cables from the entrance of each telecommunications room to the patch panel.

All outlet jacks, patch panels, racks, cables, and other hardware shall meet the requirements of TIA/EIA 568A Category 6. Pin out to be 568b. Cables shall be rated Category 6E to provide additional overhead bandwidth.

Install a pull cord in all empty conduits.

Do not install cable trays above light fixtures.

**Workstation Telecommunications Outlets:**
Unless noted otherwise, furnish telecommunications workstations with the following items:

Adequate lighting for office work throughout the room, and 120 VAC duplex convenient outlets located where necessary by consultation with User and in compliance with the National Electrical Code (NEC). Provide special CRT diffusers on lighting fixtures.

One 20A, 120 VAC, isolated ground, duplex convenience outlet where deemed necessary in consultations with the User (computer outlet).

One 20 amp, 120 VAC, standard duplex convenience outlet where deemed necessary in consultations with the User.

Provide four Category 5E or Category 6 cables for a total of four at each workstation. Ground box and conduit shall be in accordance with NEC.

**Cable Testing**

Telephone and Data Systems: The Contractor shall test the computer (data) and telephone wiring systems for conformance with the TIA/EIA 568A Category 5E or 6 (appropriate to install) wiring standards. Provide complete test results, from a level IV test unit, in PDF format. Provide the following test documentation:

- Outlet number and room number on the test result for each station cable.
- A list of outlet numbers and the corresponding room numbers and cable lengths in Excel spreadsheet format.
- Laminated half-size as-built drawings indicating each outlet location and outlet number. These will be permanently maintained in each MDF/IDF for future reference.
- Provide all documentation on a compact disk or DVD.

Warranty: It is the intent that the complete cabling system be installed to satisfy 20-year minimum warranty requirements of the cabling infrastructure manufacturers.

**Additional Requirements**

Cable: Communications cabling shall be of a fire-retardant "open air plenum" type; meeting all federal and state fire codes. The cable shall be four pair, 23 or 24 AWG cable Category 6 cable. Cable shall have cable length markers minimum every two feet and relevant UL markings. Cable type to be above base level Category 6 cable. Qualified cable manufacturers are Berk-Tek, Mohawk, and Superior-Essex. There shall be no proprietary connectivity parts, each cable manufacturer shall use connectivity parts associated with their respective “partners” (i.e. Superior Essex/Ortronics, Mohawk/Hubbell, Berk-Tek/Leviton). Jacket color shall be blue.
Two horizontal managers should be provided for each 48-port patch panel provided. Provide 10% additional patch panels, horizontal managers, outlet jacks, and faceplates of quantity installed. Provide two patch cables per installed patch panel ports in the following lengths and colors:

- Black patch cables = number of data outlets. 5% = 5 ft, 45% = 7 ft., 45% = 10 ft.
- Black patch cables = number of voice outlets + data outlets. 90% = 10 ft, 10% = 20 ft.

Longest path routing in wiring closets should be used to provide additional cable for an equivalent service loop of at least 2 meters.

To allow for future growth inside of wiring closets, racks should be placed to maximize the number of racks that can be fit into the available space.

Finish color for racks and associated patch panels, vertical and horizontal managers should be black.

Racks should be two-post 8’ X 19” equipment racks with TIA/EIA standard hole spacing and with rack unit markings.

Typical Rack Arrangement for Telecom Closets:
- Rack #1 (closest to wall): Fiber panel
- Rack #2: Network switches and 48VDC supply
- Rack #3: Data patch panels
- Rack #4 (if required): Spare

Cable tray used in the wiring closets and for distribution should be basket tray, sized appropriately for cabling capacity necessary for the building at a fill rate of no more than 40%. Acceptable manufacturers are B-line/GSMetals/Flextray and Cablofil.

Perimeter cable tray should typically be installed in the wiring closets. Cable tray should be mounted 4 to 6 inches above racks.

Do not install cable trays above light fixtures.

Firestop in high density wiring locations is preferably STI EZPath.

In general, install cable runs in conduit (EMT) back to the cable tray. Leave approximately 18" of cable slack at the cable tray end of the conduit. Coil and secure the slack cable to the end of the conduit. No not leave cable slack in cable tray.

Category 6 Wiring Installation:
- Do not strip cable sheath back more than is necessary to complete the termination.
- No wire pairs untwisted more than 1/2".
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- Install cabling without kinks.
- Bend radius should be greater than 4 times the cable diameter.
- No damage allowed to the sheath. If damaged, cable should be replaced.
- Install cabling runs at least 6 inches away from fluorescent lights in suspended ceilings and 1 ft from power outlets.
- Use Velcro cable ties; do not compress wire bundles.
- Support cable bundles as appropriate using only industry-standard fittings.
- Separate cable runs from power cabling by a minimum of 12 inches parallel and 3 inches crossing.

Install two cables to each location designated for a wireless access point. As a general rule, wireless access point locations should be planned for on a 60 ft. grid, modified as necessary to make allowance for the building structure and for the areas intended purposes. For above ceiling locations, install each cable with a 20 ft. service loop at the access point end. Terminate the cables with an RJ45 plug or RJ45 outlet in a two-port surface-mounted plenum-grade mount. Wireless access points should generally not be located in ceilings above 14 ft. In those locations, strong consideration should be given to a wall-mounted outlet. Locate wall-mounted outlets for access points no more than 14 ft. above the floor.

Test all installed Category 6 cable according to the complete Category 6 test standards for permanent link using a Level IV test unit such as a Fluke DTX-1800. The unit must have been calibrated within the last year. Provide proof of calibration at the pre-testing meeting.

Label all patch panels, cables, and outlets according to the campus labeling standard. Verify labeling scheme with the campus IT department.

Fiber riser cables from the MDF to the IDF s may be armored or be installed in sub-duct. Sub-duct preference is Maxcell.

Fusion-splice fiber cables in wiring closets to factory-made ST UPC pigtails.

Provide fiber patch cables equal to the number of fiber strands terminated times two. Single mode patch cables should be yellow, UPC polish, factory made, with test results provided, in the following lengths:

ST-LC, 3m: 50%
ST-ST, 3m: 50%
ST-LC, 5m: -50%
ST-ST, 5m: 50%

Test all installed fiber cables using an optical time domain reflectometer (OTDR) suitable for the media and length. Submit full test results.
All data contractor installation personnel must be BICSI Certified Installer Level I or higher. The onsite supervisor of the data contractor must be a BICSI Certified Technician. The data contractor must have on staff a BICSI Certified RCDD. All certifications must be current. Proof of certification must be presented at the pre-installation meeting.

**Intercom and Audio Video Systems**

Coordinate all requirements for intercom, video, and audio equipment with FPC Project Manager and User Coordinator. Provide power outlets, conduit, wire and grounding as required. Provide a cable television distribution system. As a minimum, provide a complete sound system including ADA/TAS hearing assistance system and all reasonable infrastructure for audio-visual equipment and appurtenances for all classrooms, meeting rooms, and auditoriums whose seating capacity exceeds 50 seats.

**Cable Television System**

Provide all cabling, radio frequency (RF) Amplifiers, RF Passives, and all appropriate accessories to for a complete and operating RF distribution system capable of delivering distortion free video, audio, and data signals.

The RF distribution system should be capable of delivering CATV Channels 2 through 135. The RF distribution system begins at the centralized demarcation point in the MDF Room and ends at the wall outlet locations.

The RF distribution system should be two way compatible with the ability to transmit all frequencies between 5 and 40 MHz from the wall plate back to the demarcation point.

Locate all amplifiers, splitters, and multiport directional couplers in a telecommunications room. Homerun all cables between the telecommunications room and wall outlets with cable lengths not to exceed 300 feet.

All forward amplifiers shall have a minimum of 30 dB gain and a minimum bandwidth of 54 – 862 MHz with a flat frequency response no greater than 1.5 dB.

All reverse amplifiers shall have a minimum of 16 dB of gain and a minimum bandwidth of 5 – 40 MHz with a flat frequency response no greater than 1.5 dB.

All cables between the demarcation point, amplifiers, splitters, and multiport directional coupler locations shall be plenum rated, bonded-foil tri-shield construction Type RG-11 coaxial cable.

All cables between multiport directional coupler locations and wall outlets shall be plenum rated, bonded-foil tri-shield construction Type RG-6 coaxial cable.
All splitters used to divide trunk runs and multiport directional couplers used to feed wall outlets shall be 5 MHz to 1 GHz, 130 dB RFI shielding and solder-sealed precision machined F ports.

Connectors shall be F-type and designed to be used with the installed cable.

Non-locking 75 ohm terminators shall be installed on all unused ports on splitters and multiport directional couplers.

The forward signal level at each wall outlet shall have no greater than a 10dB tilt across the bandwidth of the distribution system, 54 to 862 MHz. The signal level shall not fall below 0 dBmV and shall not exceed 15 dBmV.

**Campus Specific Information**

**Texas A&M University**

**Telecommunications and Computer Infrastructure Requirements**

These requirements are in addition to the General Information section. The General Information section should be used as the starting point. This section is intended to provide additional guidance for the College Station campus to the A/E to provide infrastructure wiring to support both voice and data communications.

**Manholes and Handholes**

Manholes: Oldcastle #264UTT612MH

Handholes: Oldcastle (contact manufacturer for dimensional information)

**Telecom Equipment Rooms**

Provide 20A, 120V outlets (NEMA L5-20R) located as needed at the base of the rack locations should be installed for a 48 VDC supply in the MDF and in the appropriate telecom rooms. Typically, this will require three outlets in the MDF and one in each IDF.

Equipment outlets should be 20A, 120V duplex receptacles mounted at the base of each equipment rack. Coordinate with TAMU-IT for quantities of duplex receptacles needed per equipment requirements.

**Building Primary Terminal Room Facilities:**
Provide 30A, 120V outlets (NEMA L5-30R) located as needed at the base of the relevant rack locations should be installed for a 48 VDC supply in the MDF. Typically, this will require three outlets in the MDF.

Equipment outlets should be 20A, 120V duplex receptacles mounted at the base of each equipment rack. Coordinate with TAMU-IT for requirements.

**Floor /Zone Terminal Closet Facilities:**

Provide 24-strand single mode fiber optic backbone cable between MDF room and all IDF rooms in a star configuration. For each IDF room within 270 physical feet of the MDF, provide 12 Category 6 cables terminated to patch panels separate from the station cables. Additional fiber and copper tie cables may be needed for large IDFs with more than 240 station cables.

Equipment outlets should be 120V 20A duplex receptacles mounted at the base of each equipment rack.

Provide a 120V 20A outlet (NEMA L5-20R) at the base of the relevant equipment rack for the 48V DC supply.

**Station Telecommunications Cable Distribution Facilities:**

All outlet jacks, patch panels, racks, cables, shall meet the requirements of TIA/EIA 568-A Category 6. Pin out to be 568B.

**Station Telecommunications Outlet Facilities**

Each station outlet shall have a deep (3-1/2 inch) dual gang box with a dual gang faceplate.

Two 1 inch conduits shall run from the outlet box to the nearest cable tray.

Outlet box should be located a minimum of 12 inches from nearest power outlet.

**Cable Testing**

Provide complete test results, from a level IV test unit, in PDF format. Included on the test result for each station cable should be the outlet number and room number. Provide copper test results in Linkware format when tests are done on a Fluke level IV test unit. Also, in Excel spreadsheet form, a list of outlet numbers and the corresponding room numbers and cable lengths, should be provided. Laminated half sized as built drawings indicating each outlet location and outlet number should be provided for installation in
Additional Requirements for Texas A&M University:

The A/E design team shall include a data/voice/audio/video design consultant with BICSI RCDD credentials and with extensive previous experience in university building design environment. The consultant should also provide support during the construction process to verify that the submittals, test procedure and actual installation meets the requirements as specified for the project.

Warranty- It is the intent that the complete cabling system be installed to satisfy 20-year minimum warranty requirements of the cabling infrastructure manufacturers.

MDF and IDF closets should be designed to accommodate a minimum of 50% increase in used rack space beyond the final building requirements.

Cable--communications cabling shall be of a fire retardant "open air plenum" type; meeting all federal and state fire codes. The cable shall be 4-pair, 23 or 24 AWG cable Category 6 cable. Cable shall have cable length markers minimum every two feet and relevant UL markings. Cable type to be above base level Category 6 cable. Qualified cable manufacturers are Berk-Tek, Mohawk, and Superior-Essex. There shall be no proprietary connectivity parts, each cable manufacturer shall use connectivity parts associated with their respective "partners" (i.e. Superior Essex/Ortronics, Mohawk/Hubbell, and Berk-Tek/Leviton). Jacket color to be blue.

An appropriate number of outlets for voice and data communications are to be installed in the various areas as per the building user requirements.

A typical station outlet in a single occupant office is to have four Category 6 cables. Two RJ-45 jacks are to be mounted in the upper portion of the left gang of the outlet faceplate for data and two RJ-45 jacks are to be mounted in the lower portion of the left gang of the dual gang faceplate for voice. The right gang of the outlet box should be filled with blanks. Jacks are to be wired as TIA/EIA-568B. Qualified manufacturers are Ortronics, Leviton, and Hubbell. Part numbers for TAMU supported outlets should be obtained from TAMU Networking.

Provide the following telecommunications outlets in a standard office unless otherwise requested by the User:

Data:
- Two data lines and two terminals at one location near the desk. The data outlet is typically mounted on the side wall furthest from the door and 4 feet out from the back wall of the room.
- An additional data line (1 outlet) may be desired at one end of the room for a small table.
Voice:
• One voice terminal at same location as the data outlet.
• If VOIP (voice over IP) is used exclusively of analog voice, the data outlet will suffice and the analog voice may be omitted.

Category 6 patch panels should be 110 style 48-port. No angled patch panels, If modular patch panels are used, all stations on patch panel are to be populated with jacks. Horizontal managers should be 5”-6” deep 2U with attached covers. Ten inch double sided vertical managers should be placed between racks. Six inch vertical managers should be placed at the row ends.

Two horizontal managers should be provided for each 48-port patch panel provided. Ten percent additional patch panels, horizontal managers, outlet jacks, and faceplates should be provided above the number installed. Two patch cables per installed patch panel ports should be provided in the lengths and colors as proportioned by TAMU Networking and TAMU Telecommunications for the specific building. As a starting point:

Black patch cables = number of data outlets. 5%=5’, 45%=7ft, 45%=10
Black patch cables = number of voice outlets + data outlets. 90%=10 ft, 10%=20 ft

Longest path routing in wiring closets should be used to provide additional cable for an equivalent service loop of at least 2 meters.

To allow for future growth inside of wiring closets, racks should be placed to maximize the number of racks that can be fit into the available space.

Finish color for racks and associated patch panels, vertical and horizontal managers should be black.

Racks should be two-post 8’X19” equipment racks with TIA/EIA standard hole spacing and with rack unit markings.

In general, for a 3rack closet the rack closest to the wall should contain the fiber panel, the next rack over would be for Data patch panels, the next rack over for data Switches, and in a 4 rack closet the next rack will be used for spare. In the MDF, an additional rack space may be needed to accommodate the 48VDC supply.

Cable tray used in the wiring closets and for distribution should be basket tray, sized appropriately for cabling capacity necessary for the building at a fill rate of no more than 40%. Acceptable manufacturers are B-line/GSMetals/Flextray and Cablofil.

Perimeter cable tray should typically be installed in the wiring closets. Cable tray should be mounted 4-6 inches above racks.
Fire stop in high density wiring locations is preferably STI EZPath.

In general, cable runs should be in conduit back to the cable tray. Approximately 18" of slack should be left at the cable tray end of the conduit. The slack should be coiled and secured to the end of the conduit. Slack should not be left in the cable tray. J-hooks are allowed only on a case-by-case basis.

Install Category 6 cabling as follows:
Limit cable sheath stripping to lengths needed only to make the termination.
Maximum untwisted wire pairs: 1/2 inch.
Install cabling without kinks.
Minimum bending radius: 4 times the cable outside diameter (unless noted elsewhere in this Division).
Damaged cables, including outside sheath, shall be replaced at no cost to the University.
Install cabling runs at least 6 inches from fluorescent lights in suspended ceilings, and 1 ft. from power outlets.
Do not compress cables; use Velcro cable ties to bundle cables.
Support cable bundles using industry-standard fittings only.
Minimum separation of cable runs from power conductors: 1 ft for parallel runs and 3 inches for crossing runs.

Install two cables to each location designated for a wireless access point. As a general rule, wireless access point locations should be planned for on a 60 ft grid, modified as necessary to make allowance for the building structure and for the areas intended purposes. For above ceiling locations, install each cable with a 20 ft service loop at the access point end. Terminate the cables using a RJ45 plug or RJ45 outlet in a two-port surface-mounted plenum-grade mount. In general, do not locate wireless access points in ceilings above 14 ft. In those locations, strong consideration should be given to installing a wall-mounted outlet. Locate wall-mounted outlets for access points no more than 14 ft. above the floor.

All Category 6 cable installed should be tested to the complete category 6 test standards for permanent link using a Level IV test unit such as a Fluke DTX-1800. The unit must have been calibrated within the last year. Proof of calibration should be provided at the pre-testing meeting.

Labeling of patch panels, cables, and outlets should adhere to the TAMU Labeling standard. A current copy is available from TAMU-IT Networking. Acceptable manufacturers for labels are Brady and Panduit.

Fiber riser cables from the MDF to the IDFs can be armored or can be installed in sub duct.
Sub duct preference is for Maxcell.

All Fiber connections shall be fusion spliced, ST type to ST type connectors.
Fiber patch cables should be provided equal to the number of fiber strands terminated times 2. Single mode patch cables should be yellow, UPC polish, factory made, with test results provided, in the following lengths:

ST-LC, 3m - 50%
ST-ST, 3m - 50%
ST-LC, 5m- 50%
ST-ST, 5m-50%

All fiber installed should be tested with an OTDR suitable for the media and length and full test results provided. Test results will be provided to TAMU-IT upon completion in both PDF. and Linkware formats.

There should be a pre-installation meeting with the general contractor, data contractor, FPC Project Inspector, and TAMU Networking representative to review the installation requirements and planned installation.

There should be a pre-testing meeting with the general contractor, data contractor, FPC Project Inspector, and TAMU Networking representative to review the test requirements and plan for all fiber and copper installed.

All data contractor installation personnel must be BICSI Certified Installer Level I or higher. The onsite supervisor of the data contractor must be a BICSI Certified Technician. The data contractor must provide BICSI credited Fusion Splice Technician. The data contractor must have on staff a BICSI Certified RCDD. All certifications must be current. Proof of certification must be presented at the pre-installation meeting.

Itemized unit pricing per cable/outlet jack should be provided as part of the submittals for use in adding additional cabling during the project.

**Emergency Telephones**

Emergency Telephones will be installed outside of new campus buildings as specified by the TAMU Campus Safety Committee. Where requested the telephones will provided and installed by the contractor. Manufacturer to be RamTel with the following features:

- PLC8 Stainless Steel Column Light
- 1 - GBF-2 Glass bead Finish
- 1 - RR735
- 1 500-1179 J Bolts and Template

Infrastructure will include a 20”x20’ by 3’6” deep footing with 4 J-hooks inserted. A template for the slab and J-hooks will be provided by TAMU Telecommunications.
The project will also provide a 20A, 120V emergency power circuit from the building to the slab installed in conduit and a one inch vacant conduit for communications wiring.

**Distributed Antenna System (DAS)**

Provisions shall be made for new buildings constructed on campus to accommodate a distributed antenna system (DAS) to enhance wireless communications (e.g., cell phones) within the building area. The roof-mounted communications equipment for the DAS will be provided by the communications service carrier, typically at some point after the building has been constructed. The building construction contractor shall provide the following equipment, wiring, and raceways at selected location(s) on the roof of the building to support the communications equipment:

- One 100A, 120V, 12-circuit panelboard with main circuit breaker in a NEMA 3R enclosure. Supply the panelboard from the nearest electrical room or point of available power in the building.
- Provide a dry-type step-down transformer in a NEMA 3R enclosure at the location of the panelboard as may be required to reduce voltage drop and minimize the length of the 100A supply circuit to the panelboard. If a transformer is determined to be needed, consider specifying a combination transformer/panelboard assembly such as the “Mini Power-Zone” product manufactured by Schneider Electric.
- One 20 inch X 20 inch X 6 inch or larger NEMA 4 enclosure for communications cabling, located adjacent to the roof-mounted power equipment.
- One 1 ½ inch empty conduit with pull string from the nearest IDF room to the communications enclosure for fiber cable to be furnished and terminated by the communications service carrier.

If possible, coordinate the above requirements with the campus DAS communications service carrier prior to installation, as these may change depending on the carrier’s equipment specifications.

**Audio/Video for Registrar-controlled Classrooms**

All of the equipment and cabling listed is needed as specified or equivalent items may be substituted in order to meet the requirements.

Mounted Equipment requirements:
- Chief CMA440 Lightweight Above Tile Suspended Ceiling Kit
- Hoffman A20N16BLP-CUSTOM Hub Box (NEMA 1 ENCL-BLACK/VENTED HOFFMAN
  ** DIRECT ORDER ** T009 color with lock and 4” louvers on each side) with HOFFA20N16MP Panel
- Electric Projection Screen of adequate size for the room
• DA LITE 40973 Single Motor Low Voltage Controller installed at Screen with proper switch installed in wall near lectern location
• In smaller rooms, where smaller speakers will suffice, ceiling mount JBL 8Ω Speakers need to be installed, for larger applications, a more specific speaker system will need to be decided upon.

Wire Runs:
• Liberty cable 22-2P-CMP-Siamez audio cable/Plenum rated or equivalent
  - Position:
    ▪ Back of room with Hub Box housing running to front of room inside lectern.
    ▪ 2 sets of the 22-2P-CMP-siamez audio cable.
• Liberty cable 20-3C-PS-WHT speaker cable/Plenum rated or equivalent
  - Position:
    ▪ Back of room with Hub Box housing running to front of room inside lectern.
    ▪ 1 set of the 20-3C-PS-WHT
    ▪ Middle of room from first ceiling speaker to front of room inside lectern. This wiring configuration is to support stereo audio and the installed speakers should be wired as such.
    ▪ 1 sets of the 20-3C-PS-WHT
    ▪ Low voltage controller by screen to inside lectern
    ▪ 1 set of the 20-3C-PS-WHT
• Cat 6 cable/Plenum rated
  - 1 cat 6 cable running from Black Box housing to front of room inside lectern.
    ▪ Used for feeding video back into computer via s-video over Ethernet adapter.
  - 3 cat 6 cables running from projector to front of room inside lectern.
    ▪ 1 cat 6 line used for serial communication
    ▪ 1 cat 6 line used for vga over Ethernet
    ▪ 1 cat 6 line used for s-video/video over Ethernet connection

Power Receptacles requirements:
• Hub Box
  - 8 total outlets inside box (two Quad/Double-Gang Receptacles).
• Projector
  - 2 total outlets attached to projector ceiling plate visible below ceiling tile.
• Lectern
  - Power receptacles added under podium via conduit hidden beneath stage or floor.
    ▪ If unavailable, receptacles should be located as close to podium as possible.
    ▪ A total of four (4) power outlets are needed

Network Connection using Category 6 cable Requirements:
• Two network connections ran to Lectern Location with 10 Foot of slack outside conduit
  o One of the connections will have a network switch installed on it to split the connection for the Lectern Equipment
  o The remaining connection will be for the Laptop Connection
• One network Connection located at the back of the room for the camera. The camera location will vary depending on the entrance to the classroom, equipment location, as well as structural limitations such as support posts, etc. Having enough slack on this line will be crucial

**Metering & Building Automation Communications**

All buildings will have meters installed that record consumption. These meters will utilize the campus Ethernet and the Category 6 communication cabling within the building. The PowerLogic electric meters and the WAGES PLC will utilize a Category 6 Ethernet cable to an EGX-400 Ethernet gateway. The Siemens DDC systems will communicate with a Category 6 communication cable to a designated DDC panel, a separate additional communications network, specifically for the DDC system, using Category 6 cable will be installed for communications between the DDC panels. This separate DDC communication network will have the Category 6 wiring installed by the ATC. Any switches, terminations, and set-up and integration will be provided by the owners Siemens representative as part of the owner provided DDC system. This separate network will be managed and maintained by the Utilities and Energy Management.

**West Texas A&M University**

**Telecommunications and Computer Infrastructure Requirements**

<table>
<thead>
<tr>
<th>Data Outlets</th>
<th>Ortronics Series II &amp; fully compliant with EIA/TIA 568A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data jacks will be 8 pin keyed RJ-45</td>
</tr>
<tr>
<td>Voice Jacks</td>
<td>Voice Jacks will be 6 pin RJ25C</td>
</tr>
<tr>
<td>Connecting Blocks</td>
<td>Ortronics OR-851044562 with trough for data termination</td>
</tr>
<tr>
<td></td>
<td>Ortronics OR-30200020 for voice termination</td>
</tr>
</tbody>
</table>

**Tarleton State University**

**Summary**

This document identifies Tarleton State University communication infrastructure standards. The communication infrastructure supports the campus voice, data and cable
television communication network. Prior to any cable being pulled at Tarleton, Telecom is required to obtain approval from the Director of Risk Management to certify the cable route is asbestos free.

Tarleton purchases and installs components for a structured cable system utilizing a Belden/ Ortronics integrity solution. Ortronics provides Tarleton with a 25-year system and applications warranty on all parts and labor. Warranty commences at the time of completion. Tarleton Technicians are Belden/Ortronics integrity certified installers and are authorized to provide cable warranty certifications.

Quality Assurance

Tarleton uses and installs materials and equipment in compliance with the latest applicable standards from ANSI, FCC, ASTM, TIA/EIA, IEEE, NEC, NFPA, NEMA, REA and UL includes but not limited to.

A. ANSI/TIA/EIA-568-C.0 and C1 Standards, Commercial Building Wiring Standard
D. ANSI/TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
E. ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications
F. Institute of Electrical and Electronic Engineers (IEEE) Standards
G. Underwriters Laboratories (UL)
   1. UL 467 Grounding and Bonding Equipment
H. National Electrical Code (NEC) (Latest revision and pertinent addendums)
I. National Fire Protection Association (NFPA) Publications (Latest revision and pertinent addendums)

Information outlets for data and voice communication shall be fed using the horizontal cable system. The horizontal system consists of plenum rate 4-pair unshielded listed Pair (UTP) Belden cable (CAT 6). Information outlets will accommodate future installation of telephone, computers, and modems.

A. Horizontal Wiring System (voice & data)
   1. Tarleton Cable pulls are no longer than 270 feet.
   2. CAT 6E is cable is orange for data and white for voice. It is used for all new construction or if specifically requested.
3. The 568B Pin out sequence is always used.

4. A 36” service loop is provided in the ceiling above each jack location for all copper cables. These service loops shall be neatly dressed and properly supported.

5. Voice cable is terminated on 110 Cat6 Patch Panels in the closet and RJ45 flush mount jacks at work station.

6. Data cable is terminated in 19” equipment rack mounted Ortronics patch panels in the closet and RJ45 flush mount jacks at the work station.

7. Caddy J hooks are installed to support all horizontal cables. J hooks are installed no more than five (5) feet on center and are installed using only Caddy approved installation methods and materials.

8. All conduct, sleeves or any other penetrations are properly fire-stopped.

9. All conduits for data and voice workstations will be stubbed out to the nearest cable tray.

B. Equipment Room

Contractor must use the appropriate Industry codes and standards. Contractor must submit a proposed layout to Tarleton Telecom for approval prior to 100% design completion.

C. Intrabuilding Fiber Optic Cable

Contractor is responsible for installing, terminating, labeling and testing any required intrabuilding fiber. Contractor must submit a proposed cable route to Tarleton Telecom for approval prior to 100% design completion.

D. Intrabuilding Copper Cable

Contractor is responsible for installing, terminating, labeling and testing any required intrabuilding fiber. Contractor must submit a proposed cable route to Tarleton Telecom for approval prior to 100% design completion.

Testing

A. Each data run is tested to compliance with ANSI/TIA/EIA standards, including but not limited to, continuity, length, anomalies, and attenuation.

B. Records are maintained on all test results. Fiber terminations are outsourced but require bi-directional OTDR testing, including launch and landing reel as well both wavelengths for each type of fiber specified.
Identification, Labeling and Documentation

A. Tarleton labels all terminal blocks, patch panels, cabling pairs, wiring pairs, and both ends of each cable between the work station outlet and the closet.
B. Tarleton uses a mechanically generated white label with black lettering to label both the outlet face plates and patch panel.
C. Tarleton's labeling scheme is customized.

Approved Equipment List

Fiber: Corning (Siecor) - ST connectors
Outdoor Fiber-

**Single Mode Fiber-Optic Backbone:**

- 48-strand, outside plant type for duct installation
- 8.3/125 Single Mode
- Wavelength 1310/1550 nm
- Dry water blocking technology
- Standard 3.0 mm buffer tube size
- Stranded, loose tube design
- Maximum attenuation 0.5/0.4 dB
- All dielectric construction
- 10 Gigabit Ethernet Distance of 1000 meters @ 1310nm; 40000 meters @ 1550nm light wave

**Multimode Fiber-Optic Backbone:**

- 48-strand outside plant type for duct installation
- 62.5/125Nm Cable
- Wavelength 850/1300 nm
- Dry water blocking technology
- Standard 3.0 mm buffer tube size
- Stranded, loose tube design
- All dielectric construction
- Serial Gigabit Ethernet Distance of 500 m @ 850nm; 1000 m @ 1300nm light wave

**Indoor Fiber Single Mode Fiber-optic Backbone:**

- 24-strand Single Mode Cable
- 900 Nm Tight-buffered
- OFNR Riser-rated, Flame Retardant jacket
- All dielectric construction
- 10 Gigabit Ethernet Distance of 10000 meters @ 1310nm; 40000 meters @
1550nm light wave
Acceptable Products:
  Corning MIC Riser, Part Number 024R81-33131-24

**Indoor Fiber Multimode Fiber-optic Backbone:**

24-strand Multimode Cable
900 Nm Tight-buffered
OFNR Riser-rated, Flame Retardant jacket
All dielectric construction
Serial Gigabit Ethernet Distance of 500m @ 850nm; 1000 m @ 1300nm light wave
Acceptable Products:
  Corning MIC Riser, Part Number 024K81-33150-24

  Rack Mount Fiber Cabinet (item CORNING CABLE SYSTEMS CCH-01U)

  Fiber Adapter Panels Multimode Refer to vendor for correct panel size and part number for ST ends

  Fiber Adapter Panels Single mode Multimode Refer to vendor for correct panel size and part number for ST ends

  Composite Ferrules
  All fiber termination will be fusion spliced using Corning manufactured pigtails.

**Copper: Essex PE-89**

The voice cables will be jumped with a 25 pair cables from the Circa to an Ortronics patch panel.

The horizontal voice will be terminated on an Ortronics patch panel.

Building Entrance- Circa 1880ECA1-100G for backbone cable

The voice cables will be jumped with a 25 pair cables from the Circa to an Ortronics patch panel part #. OR-PHD-66U48

The horizontal voice will be terminated on an Ortronics patch panel.

**Voice& Data Workstation Wiring: Belden/Ortronics (EIA-TIA 568B)**

  Cable: Belden Cat6 (item # 7882A), Data - Orange, Voice - White

**Hardware, general- Ortronics**

  Faceplates (item # OR-40300158
Blanks (item# OR-40300164)

**Hardware, Cat 6 – Ortronics**

- Single Data or Voice Jack (item # OR-S21600)
- Double Data or Voice Jack (item # OR-S22600)
- Patch Panel (item # OR-PHD-66U48)

**Equipment Racks**

- **Ortronics Rack**
  - OR-604004600 19 inch 7 feet tall
  - Horizontal cable management - OR-808044549
  - Vertical Cable Management –OR-60400437

**Raceways and Cable Trays**

A. **Center Spline Cable Tray:**
   1. Standard 10' aluminum sections
   2. Tray depth 4”
   3. Tray width 9”
   4. Rung spacing 9”, factory fitted end caps
   5. Provide outside tray enclosure (bottom cover) and screw-down top cover in open-ceiling areas
   6. Load bearing Class NEMA 12C, 161 Lbs. per linear foot
   7. Provide elbows, tees, crossovers, cable roll-outs, stiffener bars and all support and mounting hardware
   8. Acceptable Product:
      a. Wiremold SpecMate
         1) CA040909 9” W X 4” D Center spine cable tray
         2) A0412-120-DOTE - Outside Tray Enclosure for Tray
         3) Tray Top Cover
      b. Cooper B-Line
         1) C4ADT09-09-120 9”W X 4” D Center spine cable tray

B. **Telecommunications Rooms Cable Tray:**
   1. Ladder Type Cable Tray.
   2. Tray width 18”
   3. Provide unobstructed access to tray cantilevered wall-mount, or stand-off of equipment racks
   4. Provide elbows, Tees, crossovers, cable roll-outs, and hardware as required for complete system
   5. Acceptable Product:
      a. WireMold SpecMate F Series
         1) CF040918 18” Aluminum Ladder Tray
      b. Cooper B-Line
         1) 34A09-18-120 18” Aluminum Ladder Tray

**System cabling and wiring**
General: Provide proper cabling, connections, and terminations for Category 6E cabling installation.

The station cabling shall extend from each designated data and telephone jack to the assigned TR or the ER, in a star topology.

The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends (no less than 6 inch inside radius) that could compromise the integrity of the cabling.

Communications cable must not be fastened to electrical conduits, mechanical ductwork/piping; sprinkler pipes, or routed to obstruct access to doors, utility access panels, or service work areas.

Take precaution to prevent and guard against electromagnetic and electrostatic interference and hum. Do not route cables through ventilation shafts, nor parallel with line-voltage electrical conductors.

Communication cables shall not be run loose or laid upon on ceiling grid or ceiling tiles.

Cables shall be run in bundles above accessible ceilings and supported with cable support devices attached to building structure.

Cable bundles shall be run down the perimeters of the main corridor whenever practical.

Provide cable rated for environmental air type plenum where required.

Avoid cable stress due to cable twist during pulling or installation, tension in suspended cable runs and tightly cinched cable ties.

Support shall be provided by mounting appropriate cable supports for the quantity of cables in the route.

The support wires for the ceiling grid or light fixtures shall not be utilized.

Any cable support device shall not interfere with inserting or removing ceiling tiles.

The cable pathway must be positioned at least 6 inches above the ceiling grid.

**UTP Connector Termination**

Install Category 6E cable compliant with TIA 568B with 568B pin out.

Strip wire jackets only as much as is required to terminate individual pairs.
Keep pair twists as close as possible to the point of termination to lessen near end crosstalk (NEXT).

Untwisting of pairs is not to exceed 13mm (1/2 inch) for Category 6 UTP cable.

Install connecting hardware in a manner to provide a well-organized installation with cable management, and in accordance with manufacturer’s guidelines.

**Horizontal UTP Cabling**

Maximum horizontal cable run-length shall be 270 ft from the outlet to the horizontal cross connect, inclusive of ten feet of slack.

Maximum pulling tension of the cable shall be the lesser of 25 lbs or the manufacturer’s requirements.

Minimum bending radius of cable shall be six times the cable outside diameter.

Maintain a six-inch minimum clearance between the bottom of the cable tray pathway structure and the top of the ceiling.

Maintain a six-inch minimum clearance between the sides of the cable tray pathway structure and adjacent walls or other distribution systems.

Install horizontal pathways in such a manner that the minimum bend radius of the horizontal cables is kept within the manufacturer’s specifications, both during and after installation.

**Cable Management in Horizontal Pathway**

Maintain proper conduit bend radius in accordance with ANSI/EIA/TIA-569-A.

For conduit with an internal diameter of 2 inches or less, maintain a bend radius of at least 6 times the internal conduit diameter. For conduit with an internal diameter greater than 2 inches, maintain a bend radius of at least 10 times the internal conduit diameter.

Cable within pathway system to be no less than six inches from fluorescent lighting, one foot from conduit or cables used for electrical power distribution, and four feet from large motors or electrical transformers.

Fire-stop penetrations through floors or rated walls per ANSI/EIA/TIA 569 and authorities having jurisdiction with approved methods and means.

**Cable TV requirements**
RG-6 coax: Belden 9116 or P-10 PVCX1B or plenum equivalent

RG-11 coax: RG11U-RL Cabletronix 4 GHz or plenum equivalent (required for runs of 250’+)

RG-6 connector: PPC-EX6XL

RG-11 connector: PPC EX11N176 or PPC EX11

Hardware
Faceplates OR-40300158
Blanks OR-40300164
TV jack OR-60900017

Closet will need one card access. Refer to one card specs.

Smart Classroom Requirements

**Note:** Depending on the room configuration (for example if the space is to be used as a smart classroom), we would need the following; The following should be considered whenever renovating smart classrooms and/or facilities with smart cart technology.

- Projectors will require power in the ceiling within a few feet of projector.
- Power will need to be available adjacent to the wall plate that connects smart cart
- There will need to be two data drops (PC and Room Control)
- Tarleton Representatives need to be included in the planning stages so that if we need smart cabling (speakers, VGA, cat5 for smart board, etc.), we can ensure that these items are coordinated and installed during the project and not after.

**Note:** Network Infrastructure requires including the following; UPS, Wired and Wireless requirements, Closet power and cooling requirements.

**Tarleton State University’s Audio Visual Equipment Standards:**

Tarleton State University has developed a set of Audio Visual standards that are defined according to the type of classroom that will be utilized. These classroom types are separated into three categories which include: Standard Classroom, Large Classroom and Videoconferencing Classroom. Listed below are the current standards for each type of room that includes the networking and cabling infrastructure.

**Standard Classroom Itemized:**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description of Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16:10 Ratio SMART IS 422w interactive display or 4:3 Ratio SMART SSID-370-ED Symposium ID370 Interactive Display-17&quot;</td>
</tr>
<tr>
<td>----</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>DMPBD60K Blu-ray Disc Player with 1080p Upconversion</td>
</tr>
<tr>
<td>1</td>
<td>S1 1 Mid Atlantic SPACE (1 3/4”) SECURITY COVER,</td>
</tr>
<tr>
<td>5</td>
<td>32-3121BU BNC (F) - RCA (M) Adapter</td>
</tr>
<tr>
<td>2</td>
<td>32-284 DB9M-RJ45 Adapter (Hood) - GRAY</td>
</tr>
<tr>
<td>1</td>
<td>UL210BD Wiremold Outlet Center,</td>
</tr>
<tr>
<td>1</td>
<td>UTR1 Mid Atlantic HALF/THIRD RACK UNIVERSAL SHELF</td>
</tr>
<tr>
<td>1</td>
<td>D7508-WQ153357 Clear 3 Gang Wall Plate--</td>
</tr>
<tr>
<td>1</td>
<td>VZ-Blight3 Wolfvision Desktop Visualizer - VZBlight3:</td>
</tr>
<tr>
<td>1</td>
<td>150-006 6 Foot M/M Premium SVGA Cable</td>
</tr>
<tr>
<td>1</td>
<td>071-003 3 Foot RCA Python Cable</td>
</tr>
<tr>
<td>4</td>
<td>072-003 3 Foot Stereo Python Cable</td>
</tr>
<tr>
<td>1</td>
<td>060-003 3 Foot Component Video Cable</td>
</tr>
<tr>
<td>1</td>
<td>128-006 6 Feet M/M SVGA Cable With 3.5MM Audio</td>
</tr>
<tr>
<td>1</td>
<td>039-003 3 Foot Male to Male 3.5mm Stereo Audio</td>
</tr>
<tr>
<td>1</td>
<td>009-003 1 Meter, 3.3 Foot, DVI-D to DVI-D,</td>
</tr>
<tr>
<td>1</td>
<td>039-023 3 Foot Male to Female 3.5mm Stereo Audio</td>
</tr>
<tr>
<td>1</td>
<td>032-118 150 Foot USB 1.1 Over Cat5E Extension Repeater</td>
</tr>
<tr>
<td>1</td>
<td>072-025 25 Foot Stereo Python Cable</td>
</tr>
<tr>
<td>1</td>
<td>091-325 25 Foot Cat5E 350MHz Patch Cable - Black</td>
</tr>
<tr>
<td>1</td>
<td>090-125 25 Foot Cat5E 350MHz Patch Cable - Grey</td>
</tr>
<tr>
<td>1</td>
<td>092-625 25 Foot Cat5E 350MHz Patch Cable - Yellow</td>
</tr>
<tr>
<td>1</td>
<td>091-425 25 Foot Cat5E 350MHz Patch Cable - Red</td>
</tr>
<tr>
<td>1</td>
<td>090-225 25 Foot Cat5E 350MHz Patch Cable - Blue</td>
</tr>
<tr>
<td>1</td>
<td>151-025 25 Foot M/M Premium SVGA Cable</td>
</tr>
<tr>
<td>2</td>
<td>131-20 16 Foot USB 2.0 Cable, A Male to B Male</td>
</tr>
<tr>
<td>2-4</td>
<td>Quam C10 Series Speakers, mounts and back cams</td>
</tr>
</tbody>
</table>

**Large Classroom Itemized:**
The large classroom configuration will include all of the components of the standard classroom configurations except for a more powerful projector and audio amplifier. Below are the models that Tarleton State University standardized with a classroom size consisting of least 100 seats.
Videoconferencing Classroom:

Videoconferencing classrooms are custom-designed specifically for the needs of the customer and the layout of the infrastructure. Tarleton State University has standardized with Tandberg as the codec of the videoconferencing system. All other major components such as projectors and mounts are the same as the standard and large classroom configuration.

Networking:

CITDE and Telecom have combined the networking with the A/V cabling to localize all necessary wiring in one place. These connections will all be located in a standard custom faceplate created by Liberty Cable Co. Below is a description of the standard and large classroom faceplate. Videoconferencing face plates differ from each room but are all triple gang plates.

### Standard Triple gang face plate:

<table>
<thead>
<tr>
<th>Qty</th>
<th>P/N Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>R1 RJ-45 CAT 5e PUNCHDOWN (BLACK)</td>
</tr>
<tr>
<td>1</td>
<td>V5 HD-15 FEMALE FEEDTHRU (30-587)</td>
</tr>
<tr>
<td>1</td>
<td>R11WHT ISOLATED RCA SOLDER</td>
</tr>
<tr>
<td>1</td>
<td>R11RED ISOLATED RCA SOLDER</td>
</tr>
</tbody>
</table>

In a Standard classroom configuration, the location of the triple gang wall box will require two network pulls (One for the computer ladled PC and one for the room controller ladled 104). These drops will need to be terminated with Ortronics Black Keystone RJ45 Jacks part number OR-K56.

Cabling infrastructure:
Inside the walls, all AV cabling will be housed inside a triple gang wall box. This box will require one 1.5” conduit for AV cables and one .75” conduit for network cables.

**Power Locations:**

There are three primary locations that need to have power. One location is next to the faceplates that contain the networking and AV cabling. The other location is above the ceiling in approximate location of each projector. If the room consists of any electric screens, then power will be required for each of those as well.
Texas A&M Corpus Christi

Telecommunications and Computer Infrastructure Requirements

1.06 STAFFING AND QUALIFICATIONS
Contractor must be a current Leviton Premier Network Installer

1.11 CODES AND STANDARDS (REFERENCES)
Installation will meet all applicable TIA standards except where TIA standards are in conflict with Leviton installation warranties, Leviton warranties shall prevail.

2.02 ACCEPTABLE Materials and Manufacturers
A. Copper Backbone OSP
   1. Superior Essex # SEALPIC - FSF PE-89

B. Fiber OSP Backbone
   1. Superior Essex # 111443101

C. Copper Riser Cable Plenum rated
   1. Superior Essex Category 3 # 18-475-36, # 18-799-36

D. Fiber Riser Cable Plenum rated
   1. Superior Essex SM #240243101 & # 62.5 MM #240246G01

E. Horizontal Cable
   1. Superior Essex NextGain Category 6eX CMP # 54-246-2B (BLUE)

F. Fiber Optic Fusion Spliced Termination Ends
   1. Leviton Factory Terminated LC Pigtails for Multimode
   2. Factory Terminated LC Pigtails for Single Mode

G. Fiber Termination shelves (Rack Mountable):
   1. Leviton OPT-X Enclosure #5R760-00N

H. Data Patch Panels, faceplates, and Information Outlets (Jacks): Leviton
   1. QuickPort High-Density 48 Port #49255-H48
   2. Leviton dual gang # 88016-000
   3. Leviton QuickPort Quad insert # 41087-QWP
   4. Category 6+ QuickPort Connectors (Purple) #61110-RP6

I. Patch Cords: Leviton

J. Fiber Duplex Patch Cables (LC): Leviton

K. Rack mount horizontal cable management:
   1. Panduit # NCMHAEF4

L. Rack mount voice copper cable management:
1. Panduit # CMPHF2

M. Rack mount voice backbone 110 termination blocks:
   1. Leviton GigaMax #41DBR-1F5

N. Wall mount voice backbone 110 termination Blocks:
   1. Leviton GigaMax 110 #41AW2-300

O. Racks and cable management
   1. CPI 2-Post 19” Rack # XXXXXXX
   2. Panduit vertical management double sided # PRV6
   3. Panduit vertical management doors # PRD6
   4. Panduit vertical management slack spools # PRSP5

Q. UL listed horizontal and vertical cable runway ladder and related components:
   1. CPI 12” # 11275-712
   2. CPI 18” # 11275-718
   3. CPI 24” # 11275-724

R. Overhead ladder supporting hardware: CPI
   1. Runway Radius Drops 12100-712, 718
   2. Runway Pathway Dividers 13392-722

S. Emergency call box: RamTel PLW-6 w/ University logo

T. Building entrance terminal: Model #195 Lucent

U. Fiber Optic Splice Enclosure:
   1. Leviton # VSC12-STD

V. Fire Stop systems: EZ-Path

W. Labeling: Brady

X. Identification Products:
   1. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.
   2. Provide transparent plastic label holders, and 4-pair marked colored labels.
   3. Install colored labels according to the type of field as per EIA/TIA color code designations.
   4. Use TAI/EIA designation strip color-code guidelines for voice, data, cross-connect, riser,

5. 3.04 COMMUNICATIONS EQUIPMENT ROOMS

A. Prior to the commencement of any build-out of communications closets the contractor shall schedule a meeting with the Telecommunications Department to verify exact equipment placement and cable routing details.

B. Telecommunications rooms are considered floor-serving facilities. These rooms shall be equipped with fiber and copper cables, wall mounted termination block/patch panels, rack mounted copper and fiber patch panel terminations, vertical and horizontal cable management systems and passive/active equipment racks.
C. Contractor shall provide Fast Tag solution identification/labeling scheme all passive OSP and riser components installed in these rooms.

3.05 EQUIPMENT RACKS

A. Equipment Racks:
   1. Provide black anodized aluminum 19" wide x 7'-0" tall racks.
   2. Contractor shall not install equipment below 2ft AFF.

C. Install approved vendor rack radius drop on top of vertical cable management to protect cabling bend radius. See CPI part #13183-179.

D. Brace and secure top of racks with appropriate hardware by manufacturer. Secure bottom of rack to floor with 4 ½” hex screws, flat washers, lock washers and anchors.

E. Locate/space racks and enclosures (cabinet) according to EIA/TIA guide lines for front and rear access clearances and as per Telecommunications drawings.

F. As a general guideline follow the typical telecommunications room details design see attachment A.

3.06 VERTICAL AND HORIZONTAL MANAGEMENT

A. Vertical Wire Management: Double sided vertical rack cabling sections (6”W x 12.75”D x 7’H). Equip each rack, with 2 units mounted on the outside rails of each rack. Where more than one rack is installed in a single location, provide one unit installed between each set of racks and one unit located on the ends of each row.

B. Horizontal cable Management: Provide the number of horizontal rack sections as required allowing space for termination of all fiber and UTP patch panels. Quantities amounting to one unit for each UTP modular patch panel installed plus one. Install the horizontal cable managers such that there is one located above and below each patch panel in each equipment rack including the upper most and lower most locations.

C. Backboard Cable Management: Provide jumper troughs for cross-connect cable management from backbone and riser to horizontal cabling for all wall mounted termination. Mount above, below and side of termination blocks as shown on communications detail drawing.

D. Provide a minimum of 2 horizontal wire managers per 48 port patch panel.

3.07 UTP PATCH PANELS

A. Cabling within MC/TR’s, racks, and enclosures: provide adequate length of cabling. Train conductors to termination terminal points that follow manufactures installation procedures for Category 6 standards. Provide lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

B. Provide adequate number of RJ 45 48 port T568-A 8-pin Modular Category 6 patch panels for all terminations.
C. Mount patch panels and vertical/horizontal management hardware on 19” racks

D. Terminate cables in a logical ascending room number order, and consecutive number order within rooms typical.

3.08 FIBER TERMINATION PANELS

A. All communications closets and/or EOC racks and cabinets containing fiber optic terminations will use the Leviton OPT-X 1000 3RU termination shelf complete with 6 port bulkheads only.

B. Terminate Single Mode fiber with factory terminated LC pigtails.

C. Terminate Multimode fiber with factory terminated LC pigtails.

D. Provide all required tools, materials, consumables, and equipment necessary for field termination/mounting hardware for LC connectors at outlets and/or fiber patch panel locations.

E. Contractor shall fully load all fiber optic patch panels with associated hardware necessary for the termination of multi-mode and/or single mode fiber optic cabling.

F. Terminate fibers in a consistent, consecutive color-coded manner at each end. Use color-code recommendations by hardware manufacture.

G. Provide a minimum 36” of slack of buffered fiber inside each fiber optic patch panel.

3.09 VOICE TERMINATION BLOCKS (SEE ALSO SECTION 31.0)

A. Provide 110 termination blocks for voice backbone terminations complete with labeling strips, bracket kit, distribution rings, etc.

B. Provide 110 termination blocks for ancillary voice horizontal cable termination complete with labeling strips, bracket kit, etc.

C. Provide minimum 2-reel (1000’) ft. of 2-pair cross-connect UTP Category 3 cable per telecommunications room.

3.10 CABLE LADDER RACK

A. Provide at each MC/TR’s room horizontal cable runways. Equip each 19” rack with overhead ladder style aluminum cable tray installed between the wall and the horizontal/equipment racks. Refer to communications drawings for location of each runway and size of runway. Securely attach to wall studs with support brackets (and racks if applicable), complete hardware components in accordance with manufacturers written instructions.

B. Cable runway radius Bend: Refer to communications drawings.

C. Cable runway E-Bend 12” or equivalent: Refer to drawings.

D. Contractor shall provide all connection, supporting and grounding hardware for a complete overhead cable runway system.
E. Maximum-stacked height of cable installed in cable runway shall be 2-1/2”. Increase width of runway or provide additional runs of cable runway where required to fulfill requirements.

F. Communications contractor to only install pathways in communications closets. Electrical sub to provide cable tray in hallways outside of the communications rooms.

3.11 CABLE SUPPORT STRAPS, POWER STRIPS AND RACK MOUNT UPS

A. Provide cable management straps: Provide sufficient quantities to wrap all cable in MC and TR's.

B. No tie wraps will be allowed; Velcro only throughout the entire system.

C. Use Velcro for routing and securing backbone, riser and horizontal cables in a neat, loose but secure manner.

D. Provide 6 outlets horizontal power protection Strips bar for each 19” rack c/w surge protection if required. Refer to communication drawings 19” rack details.

3.12 GROUNDING

A. Provide ground lug for each 19” rack or cabinet. Rack shall be grounded to grounding conductor from wall mounted ground bus bar, using #6 AWG stranded, insulated copper conductor. Furnish all required bonding material and hardware; follow NEC manuals for bonding procedures and specifications.

B. Ground all Telecommunication hardware inside all communication rooms and wall mounted cabinet areas such as ladder rack, conduit, equipment racks, entrance protection units with #6 AWG wire.

C. Ground all hardware back to the main bus bar of two grounding bus bars installed by the electrical subcontractor. Two bus bars to be provided per communications room. One main bus bar near the racks and a second spare bus bar located near the electrical panel serving the communications closet that is grounded to the electrical panel ground.

D. Grounding system must maintain a suitably low earth resistance of 5 ohms or less. Contractor shall properly test the grounding system upon construction completion to quantify that it meets or exceeds this requirement.

3.13 PLYWOOD BACKBOARDS

A. Provided by General Contractor and/or Div. 16 Min. one (1) 8’H x 4’W x ¾” T horizontally hung, grade ACX painted plywood in MC, TR rooms and in wall mounted cabinet areas, as indicated on plans. Paint plywood backboard with two coats of fire retardant white paint. Coordinate with Architect, Prime Contractor, Div. 16 and Owner for installation of backboard. Refer to drawings for proposed location and details.

B. All plywood backboards to be mounted 24” AFF.

C. Plywood backboard must extend from 24” above the communications room floor to the build structure or slab above. See communications drawings for details on backboard and Unistrut.
above the horizontal ladder rack.

3.14 MAIN DISTRIBUTION FRAMES AND SERVICE ENTRANCES

A. Entrance: Backbone copper related hardware. Contractor shall coordinate location/placement of hardware to be mounted on plywood backboards with owner before mounting hardware to insure proper layout and requirements. Coordinate with owner’s representative Keith Franger prior to purchase and installation to verify need.

B. Provide protection modules for all incoming pairs.

C. Securely attach protector housing to wall mounted plywood backboard. Refer to communications drawings for proposed location.

D. Provide 25 pair cable whips between protector unit and 110 termination block for voice cross connection.

E. Ground Protection unit to ground bar complete with a minimum #6 AWG wire.

F. Ground Duct Rated Cable complete with a B-Bond clamp and #6 AWG wire to TMGB.

G. Provide cable runway in equipment room above all racks and up to runway/ conduits/ sleeve’s entering room from corridors to form a complete runway system connecting all hardware installations. Refer to drawings for details.

H. Cables entering all communications closets must take the longest route to their termination point within each room to allow for maintenance slack in each run.

3.15 FIBER AND COPPER SPICING REQUIREMENTS

A. Fiber and copper cables shall be continuous from end to end with no bridges, taps or splices. No splicing will be allowed to piece different cables together in a single cable run.

B. Exception to splicing will be the fusion spliced factory terminated pigtails for each fiber optic strand end terminated in the EOC and communications rooms.

3.16 INTERIOR COMMUNICATION PATHWAYS

A. Cables shall be neatly bundled along common paths. Maximum number of cables per bundle shall not exceed 24 (twenty four).

B. Electrical contractor must install factory bends, turns, junctions, and related hardware per manufacturer’s recommendations for communications pathways and to meet TIA standards for structured cabling low voltage pathways. This also pertains to the installation and routing of conduit pathways.

C. All pathways must be grounded per NEC codes and TIA standards.

3.17 PATHWAY AND SPACES

A. Chases and slots must maintain a 50 % spare capacity.
B. Refer to communications standards.

3.18 CONDUITS AND CABLE TRAY

A. Contractor shall seal all fire rated penetrations with intumescent fire-stop material that matches the rating of the surface penetrated. Coordinate fire stopping with Div. 16 and general contractor on site.

B. Do not install communication cables in conduits until all bushings and couplers are installed on the ends of the conduits.

C. Contractor shall ground all incoming communication conduit/tray into the MC and TC rooms with minimum #6 AWG green insulated jacket, braided conductor.

D. Conduit fill shall not exceed 40%.

E. Electrical contractor shall leave a ¼” dia. 200 lb test rating nylon pull cord in all conduits used for cable installation.

3.20 CABLE SUPPORT

A. Min. 1/2” dia. all threaded rod or equivalent and manufacturer components shall be used for hanging cable runway between floor deck and deck members outside of communications rooms. Follow manufacturer recommendations and standards.

B. Layout cable runs in advance to determine quantities of cable to be installed along pathways, and to insure non-interference from other trade installations.

C. Do not support cables from or lay on ceiling suspension system or use electrical, plumbing, or other pipes for support. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached, and that are suitably sized to carry the weight of the cables to be supported. Confirm with Architect and/or Prime Contractor on installation procedures for Cable Support System prior to implementation. No exceptions.

D. Support vertical fiber optical and cooper cabling with Velcro secured to vertical wall mount ladder rack sections.

E. Where a pull box is required in a vertical run of cable, coil a slack loop of fiber cable and secure with basket weave support prior to continuing in intended direction.

3.21 INNERDUCT

A. Provide separate PVC inner duct for backbone and a plenum inner duct for riser cable runs that are routed throughout this building and/or campus. Minimum one (1) 1-inch inner duct per cable. Exemption: inner duct is not required if fiber cable is encased in flexible steel Armor and complete with plenum rated orange jacket.

B. All fiber optic backbone and riser cables shall be in inner duct unless otherwise specified. For any vacant conduit in which fiber cable will be installed, populate conduit with the following:
1. Provide three (3) inner duct per 4-inch conduit as follows: Two (2) 1¼-inch and one (1) 1-inch inner duct.

2. Provide three (3) inner duct per 3-inch conduit & Two (2) 1-inch and one (1) 1¼-inch inner duct.

3. Provide one (1) inner duct per 2-inch conduit. One (1) 1¼-inch inner duct.

4. Provide one (1) 1-inch inner duct for fiber installation in existing conduit that has been currently installed with other telecommunication cabling. Ensure conduit fill ratio is maintained.

C. Fiber optical cabling running in accessible (open) ceiling space shall be provided in a separate plenum rated inner duct. Refer to drawings.

3.22 COPPER BACKBONE

3.23 FIBER OPTIC BACKBONE

3.24 FIBER OPTIC RISER INSIDE PLAN

3.25 COPPER RISER INSIDE PLANT

3.26 CATV CABLING

Both CATV and network cabling will be sometimes routed in the same pathways. Contractor must maintain organized separation from network cabling to prevent interference on the network cabling from EMI produced by the broadband system.

3.27 HORIZONTAL DATA AND VOICE CABLING

A Data and Voice Wiring.

1. All Data and Voice wiring shall be terminated in TIA/EIA wiring configuration T568-A, Category 6X, 4-pair, 24AWG, solid copper conductor, Plenum Rated Cable. Use one manufacturer only to maintain cable/components. Warranty-shall meet or exceed latest EIA/TIA specifications.

2. Cables intended for installation in ducts and wet environments shall be listed and rated for such. In the event that the Add Alternate for the Outbuilding is approved, cable for this building shall conform to this requirement. If Category 6 duct rated wet environment cabling is not available for this Add Alternate, the contractor shall inform the Design Team’s project manager and ask for direction.

3. Cable shall be UL or ETL listed type CMP with blue outer jacket.

4. Horizontal Cable: The cable jacket shall be printed with a minimum of the following information: Category specified performance marking, Manufacturer, Manufacturer’s part number, cable type, listing file number, number of pairs, listing type (i.e., CMP), and sequential footage markings.

6. Cable shall be listed in the UL or ETL Verified LAN Cable Products Directory. Cable shall meet all tests for current Category 6 specifications.

7. Provide NextGain Cat 6eX type cable with quantities to support locations specified.

8. Acceptable Manufacturers: refer to approved manufacturer.

9. Wall Information Outlet Jacks: refer to approved manufacturer.

10. Data: Category 6 T568-A wire scheme 8-pin modular jack A wiring.

11. Wall Mounted Telephone Faceplates: Provide Stainless Steel faceplate with wall phone hanging stubs wired with integral 8-position, 8-conductor voice jack wiring in accordance with the T568-A wiring designation for the termination of Voice UTP cables specified herein.

3.29 DATA PATCH CORDS

A. Category 6eX data patch cords. Refer to approved manufacturer Leviton.

B. Supply two (2) yellow patch cables (1 each 7ft and 1 ea 12 ft) for every data drop installed. One patch cable will be used in the Telecommunications room and the other shall be used at the workstation area.

C. Patch cords shall be made and warranted by the manufacturer of the cabling system installed in this project and shall meet or exceed Category 6 patch cord specifications as outlined in EIA/TIA standards.

D. Patch cords shall be in original packaging when presented to the owner. E.g., sealed plastic bags.

3.30 FIBER PATCH CORDS

A. All fiber optic patch cords to be provided by contractor. Consult owner on exact lengths and quantities prior to purchase.

3.31 VOICE PATCH CORDS, CROSS CONNECTS

A. See also T series drawings T401 Detail 2.

B. Contractor to install within each MDF/IDF 8 Category 3 - 25 pair cables from the 110 termination blocks on wall field to the rack designated for voice cabling. Terminate pairs on Category 5e 48 port patch panels using 2 pair per port. Coordinate with owner for correct pin out configuration.

C. Contractor to provide one (1) black cat5 patch cord per I/O for voice cross connections within each IDF. Patch cords to be used between the horizontal Category 6 cabling and the Category 5e 48 port voice patch panels.

D. All work area voice patch cords to be provided by contractor and shall meet all channel test requirements.
E. Cable cleaners and/or lubricants shall be materials designed and manufactured for telecommunication cabling use.

3.31 HORIZONTAL CABLELING REQUIREMENTS

A. CABLING METHOD:

1. Provide cabling in acceptable spaces, cable tray, (surface and/or enclosed raceway), conduits, cable support system. Within consoles, racks, cabinets, desks, and counters, in accessible ceilings spaces and in gypsum board partitions where open cable method may be used. Use UL or ETL listed plenum rated cable in all spaces. Conceal raceway and cabling except in unfinished spaces as is practical.

2. Utilize conduits/cable runway as indicated on the drawings. Route data and voice cables in a neat and orderly fashion. No cable ties or wraps shall be used to secure the cables in the runway outside of the MC and TR's.

3.1 Examine pathway elements intended for cable. Check raceways and other elements for compliance with space allocations, installation tolerances, debris, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Application of Media

1. Installation of OSP cables and splice cases shall follow EIA/TIA standards for cable routing and the racking of splice cases and cables in manholes. Provide Owner's representative with routing and racking plan prior to implementation.

2. Horizontal cabling when exiting runway and/or conduit, shall thereafter be supported with approved materials, and space supporting hardware to maintain performance characteristics, or as listed below.

3. Install cable using techniques, practices, and methods that are consistent with specified data cabling and the installed components and that ensure specified performance levels of completed and linked signal paths, end to end.

4. Cable bending Radius: The cable shall not be bent greater than a bend radius of 25.4 mm (1.00 in) or as specified by cabling manufacturer.

5. Cable bundles brought into the MC shall be routed and dressed in such a manner that prior to termination the cables are not subject to damage and misuse such as installers walking on the bundles that are lying on the floor.

6. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Cable Pulling shall not exceed 25lbs of pulling tension typical.

7. Install Cables in continuous lengths from communications outlet to specified patch panels for data and termination block for voice.

8. Terminate horizontal voice cables into termination blocks without damaging twisted pairs or jacket.
9. Terminate horizontal Data cables onto specified RJ45 modular Patch Panels without damaging twisted pairs or jacket.

10. Pull cables in smooth and regular motions using methods that prevent cable kinking.

11. If necessary use approved cable pulling lubricant.

12. To reduce the occurrence of micro bending of individual fiber strands, use mesh-type, swivel-eye fiber optic pulling grips.

13. Keep all items protected before and after installation with dust and moisture proof barrier materials/envelopes. If wiring is terminated on patch panels, data, voice jacks prior to painting, carpet installation, and general finish clean up, these jacks shall be placed in a protective envelope to insure dust, debris, moisture, and other foreign material do not settle onto jacks’ contacts. Envelope will be removed on final trim out after other trades have finished their finish work. It shall be the contractor’s responsibility to ensure the integrity of these protective measures throughout the life/installation of the project.

14. Do not bind cables tightly together with tie or other wraps. Use Velcro wraps instead of cables ties for all bundling in the facility. Velcro wraps shall slip loosely around bundles.

15. Pull cables simultaneously if more than one is being installed in the same raceway/pathway.

16. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.

17. No exception for exposed cabling runs.

18. No flat or under carpet communications cabling (UTC) shall be used without prior written permission of owner.

19. Provide all necessary installation materials, hardware, tools and equipment to perform insulation displacement type terminations at all data outlets, patch panels, and voice termination materials.

20. Provide horizontal cables in consistent consecutive order. Arrangement of cables on patch panels and voice termination hardware shall be in ascending order of room numbers and outlet numbers within rooms.

21. Communications Room: Numbering shall start at the left of the main door to the room and continue in a clockwise direction around the room. That is, start the wire termination on patch panels and blocks with the cables that are the lowest room number, and place them in the first patch panel and port number. In any building for example, a room 100 would be terminated first; room 101 would be terminated second, etc. in alpha numerical order.

22. Work area cables within each room will be terminated starting with the cables located to the left of the main door to the room and continue around the room in a clockwise direction and in alpha numerical order.
23. Maintain twists in cable pairs to within ½” (13 mm) of termination and/or to Leviton specifications.

24. Group all specialty cables such as the pay phone cables, which do not have their own termination hardware, in one group, clearly labeled as to cable number and function, in the last positions on the horizontal cabling blocks in each MC/TC.

25. Limit cable-bending radius to 20 times the cable diameter during installation, and 15 times the cable diameter after installation.

26. Provide one voice cable to elevator(s) voice cabling terminal(s) in this building. Coordinate with elevator installer, and client representative. Consult with General Contractor on location of terminus point and length of cable. Clearly, identify elevator- wiring locations on voice termination hardware in MC/TR’s, and on documentation of record. Terminate cable in the last position on the horizontal blocks. Reserve space for terminating additional pay phones.

27. Additional 8 pair of Cat 3 or higher, (PE-89 for outside plant) duct rated copper cable required for emergency call connectivity. Refer to drawings for location and emergency call column to be provided by cabling contractor. Coordinate exact requirements with General contractor for termination location on site.

C. Separation of Cables:

1. Comply with EIA/TIA-568-B rules for separating unshielded copper communication and data-processing equipment cables from potential EMI sources, including electrical power lines and equipment.

2. Maintain a minimum spacing of 18” from electrical feeders and/or branch circuit wiring.

3. Maintain a minimum spacing of 12” (300mm) from auxiliary systems cabling.

4. Maintain a 1” separation where UTP cables must pass perpendicularly to electrical, plumbing, or other wiring, conduit, or piping systems. Use non-conduit bushings, if necessary to maintain separation, which allow for the addition of a reasonable number of cables in the future.

5. Maintain communications pathways away from electrical apparatus such as motor driven equipment and transformers, minimum separation distance of 10’-0” (304 cm) is recommended.

6. It is a requirement of the cabling contractor to coordinate with the other trades on the project to ensure that these separations are met.

3.35 ADMINISTRATION, TESTING, AND IDENTIFICATIONS

A. These specifications will be strictly enforced. The contractor must verify that the requirements of the specifications are fully met through testing, active data throughput, and documentation as specified below. This includes confirmation of requirements by demonstration, testing and inspection. Demonstration shall be provided in final walk-through and in soft and printed test data. If part or all pairs of cable do not meet specifications contained in this document, the cable shall be replaced at contractor’s cost.
B. Test Plan: provide a complete and detailed test plan for the cabling system specified herein including a complete list of test equipment for UTP and light guide components and accessories. Include procedures for certification, validation, and testing. Furnish factory reel tests for all cable. Owner will require that the Telecommunications Cabling System installed by the contractor be fully certified to meet all necessary requirements to be compliant with referenced IEEE and EIA/TIA specifications. Must show proof of test equipment certification and installer training with qualifications in submittals.

C. Testing Agency: Contractor will engage a qualified testing agency to perform field quality control testing of all installed cable plant. This ‘agency’ may be Contractor’s personnel if the manufacturer of the testing equipment certifies them to conduct the required tests, and contractor can show proof of training on said test equipment.

D. Correct malfunctioning hardware within each permanent channel link and retest to demonstrate compliance.

E. Contractor will complete all work and documentation according to manufacturer guidelines to insure manufacturer’s warranty remains in effect. Contractor shall obtain certificates from manufacturer attesting to warranty being in effect and include certificates with other deliverables due at the completion of the project and before final payment is made.

F. Owner reserves the right to be present during any or all of testing.

G. Standards Compliance & Test Requirements: Cabling must meet the indicated performance specifications: Leviton Lifetime Warranty and latest addenda.

3.36 TEST EQUIPMENT

A. Approved UTP/Fiber test equipment: Fluke DSP 4300 or DSX 1800.

B. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.

C. Test adapter cables must be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.

3.37 DATA TESTING (COPPER)

A. Testers shall be calibrated by factory at manufacturers recommended intervals. Produce documentation to validate compliance.

B. Testers shall be capable of reporting data at all measured points and uploading the data to a printer PC/word dictionary location printer. Serial number of tester shall be included with the test results.

C. Test cords shall be new factory manufactured leads.

D. No test leads/heads shall be used for greater number of tests as recommended by manufacturer. Follow manufacturer’s recommendations. Produce documentation on manufacturer’s testing procedures and recommendation. Provide documentation on
conformance with manufacturer testing procedures.

E. Use test leads/patch cord factory made that are “tuned” to test the particular manufacturer’s cabling system used for permanent link tests.

F. Certify that tester’s software has been updated within the last 30 days prior to testing.

G. All horizontal copper cabling testing shall meet Leviton requirements to achieve channel test certification.

H. All cabling not tested strictly in accordance with these procedures shall be re-tested at no additional cost to the owner.

I. 100% of the installed cabling must be tested. All tests must pass acceptance criteria defined herein and in applicable EIA/TIA standards.

J. Test equipment shall be fully charged prior to each days testing.

**Copper Cable Procedures:**

A. Inspect all cabling for physical damage and test each conductor signal path for continuity, shorts to ground, wire mapping, line loss, and shorts. Test for faulty connector splices, and terminations. Voice cabling rated at Category 3, Category 5/e and Category 6 shall be tested as per data testing specifications.

B. Each pair of Riser copper cable shall be tested for standard wire mapping, continuity, opens, shorts, and grounded pairs. Record and deliver all tests in paper and electronic media.

C. Correct malfunctioning units at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest. Any subsequent failures noted in the retesting of all cable plant shall be corrected as noted above.

D. Contractor will complete all work and documentation according to manufacturer guidelines to insure manufacturer’s warranty remains in effect. Contractor shall obtain certificates from manufacturer attesting to warranty being in effect and include certificates with other deliverables due at the completion of the project.

E. Testing of pressurized splice cases: All exterior splice cases shall be pressure tested at 10 lbs PSI and maintain a minimum of 98% of this pressure for a minimum of 24 hours and a minimum of 95% for 48 hours.

F. Contractor shall notify Owner’s representative 48 hours prior to testing that the tests will take place in order that Owner can be present for testing.

**3.39 FIBER TESTING, POWER METER AND OTHER REQUIREMENTS**

A. Single Mode and Multi-Mode Fiber Testing: Shall conform to test procedures, bandwidth, and attenuation measures specified herein and EIA/TIA standards.

B. Cabling Contractor shall use a Power Meter AND OTDR for fiber testing complete with hard and soft copies of test results including dB loss for links.
C. Max loss shall be less than .5dB, unless manufacturer specifications are less. Testing shall be done from each end of fiber link.

D. Contractor shall obtain certificates from manufacturer attesting to warranty being in effect and include certificates with other deliverables due at the completion of the project.

E. All test equipment shall have been calibrated within the last year prior to testing.

3.41 LABELING

A. Coordinate with owner’s representative for specifications on labeling scheme of all hardware, cabling, and related equipment prior to any labeling or testing.

B. Label Fiber Optic cable runs with orange or red “Caution – Fiber Optic Cable” tags in Telecommunications Rooms, Pull Boxes, and other visible open space. Refer to approved manufacturers.

C. Use fast Tags for all Infrastructure, racks and fiber termination, OSP cable must be label throughout the entire system including within 12” of entering and exiting all penetrations in floors, walls and manholes.

D. Label conduit/inner duct every 50 feet with “Caution – Fiber Optic Cable” visible and on accessible ceiling space.

E. Labeling system: Coordinate exact labeling scheme with owner prior to commencement of labeling all systems.

F. Label each horizontal cable on the patch panel and I/O faceplate.

G. General: Label each cable within 6 inches of each termination, where it is accessible and readable in a cabinet, junction/splice case, or outlet box, and elsewhere as indicated.

H. Within Connectors Fields, in Wiring Closets and Equipment Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both communication and data-processing equipment, use a different color for jacks and plugs of each service.

I. Provide electronic copy of final comprehensive schedules for Project, in software and format selected by Owner.

J. Communications room grounding will be marked conspicuously with permanent plastic labels at each end and location stating “Caution: telecommunication Ground- DO NOT REMOVE”. Indicate the room number of the opposite end of the wire.

K. All copies (printed and electronic) of floor plans shall show outlet locations identified by their unique identifier. Place one copy of all floor plans with I/O’s in each MC/TC room. Coordinate with owner if they require specify requirements, like: lamination and mounting height, etc.

3.42 DOCUMENTATION

A. Format
1. Test reports must be submitted in hardcopy and electronic format to the
   Telecommunications Department.

2. Test reports shall include the date and time of testing as each test is carried out.

3. Hand-written test reports are not acceptable.

4. A hardcopy report is to be submitted in labeled 3 ring binders with an attached affidavit
   verifying passing execution of all tests. For large installations, electronic reports with
   hardcopy summaries are preferred. Hardcopy summary reports shall contain the following
   information on each row of the report: circuit ID, test specification used, length of cable,
   date of test, and pass/fail result.

5. An electronic report is to be submitted on CD-ROM in Microsoft Excel 2000 or later format
   to owner. Electronic reports must be accompanied by a Certificate signed by an authorized
   representative of the Contractor warranting the truth and accuracy of the electronic report.
   Certificate must reference traceable circuit numbers that match the electronic record.

6. All test reports and results must also download into Linkware for owners use.

B. Test reports shall include the following information for each cabling element tested:

1. Wire map results that indicate the cabling has no shorts, opens, miss-wires, split, reversed,
   or crossed pairs, and end-to-end connectivity is achieved.

2. For Category 3 cabling: Attenuation and NEXT data that indicate the worst case result, the
   frequency at which it occurs, the limit at that point, and the margin. These tests shall be
   performed in a swept frequency manner from 1 to 16 MHz. Information shall be provided
   for all pairs or pair combinations and in both directions. Any individual test that fails the
   relevant performance specification shall be marked as a FAIL.

3. For Category 6 cabling: Attenuation, NEXT, PSNEXT, ACR, Power Sum ACR, Return
   Loss, ELFEXT, PSELFEXT, Propagation Delay, and Delay Skew data that indicate the
   worst case result, the frequency at which it occurs, the limit at that point, and the margin.
   These tests shall be performed in a swept frequency manner from 1 MHz to highest
   relevant frequency, using a swept frequency interval that is consistent with TIA and ISO
   requirements. Information shall be provided for all pairs or pair combinations and in both
   directions when required by the appropriate standards. Any individual test that fails the
   relevant performance specification shall be marked as a FAIL.

4. Length (in meters), propagation delay, and delay skew relative to the relevant limit. Any
   individual test that fails the relevant performance specification shall be marked as a FAIL.

5. Cable manufacturer, cable model number/type, and NVP.

6. Tester manufacturer, model, serial number, hardware version, and software version.

7. Circuit ID number and project name.

8. Auto test specification used.

10. Date and time of test.

11. Test reports shall be submitted before substantial completion of the project.

### 3.44 SUPPORT AND WARRANTY

A. Contractor must be certified Leviton Premier Network Installer and show proof of current certification before work begins and be able to provide the all applicable Leviton warranties at time of installation.

B. Certified System warranty for this specific project shall be submitted in writing with system documentation prior to final billing.

C. Contractor shall provide an installation that meets or exceeds the manufacturer requirements and standards for the above warranties.

END OF SECTION
General Information

Fire Detection and Alarm Systems

The Fire Detection and Alarm System shall be designed in accordance with NFPA 72 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 license issued by the state fire marshal. All material shall be approved by Factory Mutual Laboratories and Listed by Underwriters Laboratories. Compliance with article 5.43-2, Texas Insurance Code is required.

All fire alarm systems shall be addressable systems.

Campus Specific Information

Tarleton State University

Fire Alarm System

Fire Alarm System shall be Notifier 320 panel, no substitutions allowed.

Texas A&M University-Commerce

Fire Alarm System

Fire Alarm System shall be Notifier, no substitutions allowed.

West Texas A&M University

Fire Alarm System shall be Siemens Pyrotronics
Guide Specification

Texas A&M University

Fire Alarms Specifications

Purpose: This guide specification shall serve as a design and installation standard for fire alarm systems installed on the Texas A&M University (TAMU) Campus.

I. General Information

a. The contractor shall perform all work necessary to design, install, and test any new fire alarm system installation. This includes, but is not limited to, all labor, materials, and commissioning.

b. The complete installation shall conform to the applicable sections of the most current edition of the National Fire Protection Association (NFPA) codes and standards, American Disabilities Act (ADA), the National Electrical Code, the International Building Code, the Texas Accessibility Standards Act (TAS), and these specifications.

c. All fire alarm system retrofit projects shall include a field survey of the facility to determine device locations and system layout. The walkthroughs should include a member from the TAMU/TAMUS project management group, personnel from the Facilities Department, and Environmental Health and Safety.

d. All components of the fire alarm system shall be able to interface completely with the fiber network reporting system used by Texas A&M University while maintaining a UL listing (See Annex B).

II. General Design Guidelines

All new fire alarm systems installations at Texas A&M University shall utilize the following general guidelines as a basis for the system layout. These general guidelines are for fully sprinklered buildings. These are general guidelines and may vary as determined by the AHJ during walkthrough and plan review sessions.

a. Smoke detectors
   i. Unless specified by the AHJ shall be photoelectric
   ii. Shall be installed in the following locations:
      1. All corridors and common use spaces such as lobbies, reception areas, etc.
2. Intermediate or remote areas where smoke would need to penetrate multiple doors to reach a smoke detector in a corridor or common area

3. Electrical Rooms

4. Storage rooms with large combustible loads

iii. Smoke detectors shall not be installed in
- Custodial closets
- Non-conditioned pump rooms

b. Heat Detectors shall be installed in break rooms

c. Manual pull stations shall be installed at the following locations:
   
i. Every level at every enclosed or exterior exit
   ii. In corridors where travel distance to a pull station exceeds 200 feet
   iii. Every horizontal exit as defined by NFPA 101, *Life Safety Code®*

d. Specific design issues
   
i. High-rise building specifications
      1. Provide a fireman’s phone system and boxes for phone
      2. Provide an unsupervised printer that shall record all system events and time of the event
      3. All high rise buildings will be programmed for general alarm activation (not high-rise mode)

   ii. Residence Hall specific requirements
      1. Detectors in resident hall rooms shall be combination heat/smoke detectors. Activation of the heat/smoke detector shall sound a local and general alarm.
      2. Activation of a general alarm shall activate sounder bases in all resident hall rooms.

   iii. Animal housing areas - Chimes may be installed in animal housing areas (system designer should verify with user to determine if and when this might be necessary.)

III. Instructions to Contractors

   a. The contractor shall provide three (3) copies of detailed plans, and specifications as enumerated in Appendix A for review and approval prior to installation.

   b. The contractor shall get clarification from the AHJ and approval from the FPC Project Manager when a question or discrepancy arises.
c. Upon completion of the installation and testing of the system, the contractor shall provide a structured training class to designated university personnel on troubleshooting, maintenance and repair of the installed system as requested. A manufacturer representative shall be present.

d. Contractor shall contact Radio Room and the Building Proctor before work is started each day.

e. The contractor shall provide a price list identifying any special tools and/or equipment required for inspection, testing or maintenance of any installed components. The project manager will determine any equipment needed and provide a list to the contractor. The cost of this equipment shall be included in the contract price.

f. The contractor shall provide within fourteen (14) calendar days of the acceptance test one (1) electronic copy in the native format of the BIM authoring software as well as the same information in IFC format and copies of all sheets of the Record drawings in DWG format as well as in PDF format on disk type media (CD or DVD) and three (3) hard copies of Record drawings reflecting any and all changes noted during acceptance testing. These drawing should be complete and detailed as enumerated in Appendix A. The drawings shall accurately reflect the installed system.

IV. Quality Control Assurance

a. All components of the fire alarm system shall be products of an Underwriters Laboratories Inc. listed fire alarm manufacturer, and shall bear the UL label. Partial listing shall not be acceptable.

b. All components of the fire alarm systems shall use the most current technology available.

c. Only new parts shall be installed at the time of initial installation and to repair the system during the warranty period. No reconditioned parts shall be used.

d. All devices shall be tested and certified that they meet or exceed the “Service Life Expectancy Rating” as outlined by UL and NFPA.

e. The equipment and installation supervision furnished under this specification is to be provided by a manufacturer who has been engaged in production of this type of equipment (software-driven) for at least 5 years and has a fully-equipped service organization within 150 miles of the installation site. Service shall be provided within 24 hours of problem notification.
f. All conductors shall be uniformly and consistently color-coded and labeled throughout.

g. All power supplies connected to the system shall have transient protection in accordance with UL 864.

h. Detectors **shall not** be installed until cleanup of all construction trades is complete as required by NFPA 72. Any detectors found installed prior to this cleanup will be replaced at the contractor’s expense.

i. Conduits shall not be filled to more than 40% capacity. Conduits shall have a J-box no further than 100 feet or at each 90° turn, whichever occurs first. All J-boxes shall be painted red or have the letters FA in red on the cover. Where a J-box at every 90° turn may be considered excessive, the contractor should get direction from the TAMU/TAMUS project manager before omitting any J-box. All J-boxes shall be easily accessible.

j. The contractor shall identify and label circuit breakers on main and emergency power supplies and identify these electrical panel location(s) and breaker number(s) inside the Fire Alarm Control Panel (FACP) in accordance with NFPA 72. Any breaker associated with the FAS shall be painted red.

V. Design Specifications

a. General Requirements
   i. Panels shall be easily expandable and upgradeable.

   ii. Unless otherwise approved by the Authority Having Jurisdiction (AHJ), the FACP shall have software that will enable the system to be intelligent.

   iii. All Fire Alarm Systems (FAS) shall be equipped with voice notification and have public address capability unless otherwise approved by the AHJ.

   iv. Provide software that:

       1. Is password protected

       2. Offers computer driven device calibration test and reporting features, by device, loop, or system.
3. Latches all Alarm, Trouble, and Supervisory signals, unless otherwise requested by AHJ.

v. Power for the FAS (FACP and all components) shall be from one electrical panel unless approved by the AHJ.

vi. Furnish and install “surge protection devices” on all circuits that extend beyond the main building (i.e. walkways, aerial, or underground methods):

1. Surge protection devices shall be located as close as practical to the point where circuits leave the building.
2. Surge protection devices shall have a line to line response time of less than one nanosecond capable of accepting 2000 amps to earth.
3. Surge protection devices shall comply with UL 497B and NEC 760.

vii. All addressable loops shall have loop isolation protection devices to maintain partial fire alarm system integrity should a fault occur. A loop isolation device shall not exceed a maximum of 20 devices.

viii. A maximum of 80% capacity of initiating devices is allowed per loop.

ix. The fire alarm system shall use closed loop initiating device circuits with individual zone (device) supervision, individual notification appliance supervision, and primary and standby power supervision.

x. Each device shall be labeled and the label designations shall be accurate and consistent with those on the prints, the annunciators, the points list, and message displays.

xi. All devices, panels and auxiliary panels shall be mounted in easily accessible locations. The top of all panels shall be mounted no more than six (6) feet above finished floor.

xii. The FACP will consist of a control center utilizing state of the art electronics with microprocessor-based technology and a minimum of four zone (loop) capability. The FACP shall be software controlled with the capability of owner programming. The installer will supply all programming data (complete program, data list) software and all updates to the software. Software media shall be Windows compatible using the most current version.
xiii. The FACP shall have software capable of supervising Air Handler Unit (AHU) shutdown.

xiv. The FACP will have an audible device and separate LED’s indicating ALARM, TROUBLE and SUPERVISORY conditions with each having a separate and distinguishable sound. The FACP shall have a backlit LCD display of at least three lines of at least 40 characters each. An indication of POWER, TROUBLE, and PARTIAL DISABLE shall be included as an LED output.

xv. The FACP equipment cabinet shall be of sufficient size to accommodate the main fire panel, main and standby power supplies (battery), cable and wire harnesses and any auxiliary relays.

xvi. Remote annunciators (if installed) shall have the same capabilities as the FACP in all respects unless otherwise directed by the AHJ.

xvii. There shall be a separate box located next to the FACP of sufficient size to accommodate spare detectors and paperwork (16” x 16” x 6” min.). This box shall be of matching color with the FACP cabinet and shall be keyed the same as the FACP.

xviii. Printer interface modules shall be installed in all systems.

b. Programming Requirements

i. Provide a “Drill Function” on the panel that is easily identifiable and only initiates notification appliances on all floors.

ii. Provide a Programmable “Bypass” function for:
   1. AHU shut down
   2. Elevator recall
   3. Stairwell pressurization fans
   4. Notification appliances
   5. Alarm verification

iii. Provides for all controlled systems to “auto reset,” (i.e., AHUs and elevators)

iv. Provides for all system devices to be restorable from the FACP.

c. Initiating Devices

i. All water flow switches shall be time adjustable complying with NFPA 72.
ii. Valve tamper switches shall comply with NFPA 72. A supervisory condition shall result from a tamper switch activation.

iii. Beam detectors shall:
   1. Comply with UL268
   2. Be 24vdc operation
   3. Have automatic contamination compensation

iv. Detector bases shall:
   1. Be low profile, surface, or flush mounted into a standard four inch square electrical box
   2. Be able to accept heat, ionization, or photoelectric devices interchangeably

v. Smoke detectors shall:
   1. Have an LED that flashes during normal operation
   2. Ionization detectors shall be dual chamber and be scaled against rear airflow
   3. Be self-adjusting for airborne contaminants
   4. Have clear, distinct visual alarm indication
   5. Be mounted in easily accessible locations
   6. Be programmed to have alarm verification

vi. Duct detectors shall:
   1. Report to FACP as a Supervisory Alarm
   2. Be of the photoelectric type
   3. Have clear, distinct visual power and alarm indications
   4. Be programmed to have alarm verification
   5. Have extended visual indicators if mounted above ceiling located as close to duct detector as possible

vii. Heat detectors shall:
   1. Be of the dual element, self-restoring type
   2. Have a flashing LED for normal operation
   3. Have clear, distinct visual alarm indication

viii. Manual pull stations shall:
   1. Be cast aluminum or high impact plastic and be red in color
   2. Be zoned separately if not addressable
   3. Provide a clear visual indication when activated
   4. Not require consumable parts to reset to normal condition

d. Notification Appliances

i. Audible devices:
1. Shall be tapped to an adequate wattage capable of achieving the minimum required dB reading throughout the facility
2. Shall be tapped at the highest wattage in all mechanical rooms
3. May be ceiling mounted speakers or combination devices where permitted to be installed by code

   ii. Visual devices:
      1. May be ceiling mounted or combination devices where permitted by code

VI. Installation, Testing, and Acceptance

   a. The contractor shall have all devices on the system installed and the system pre-tested prior to the scheduled acceptance test.

   b. The contractor shall provide all tools, labor, and materials required for all installation start-up tests, including a qualified technician to conduct the test.

   c. Installation and testing shall be inspected and certified by a contractor supplied NICET II (minimum) Technician.

   d. System acceptance test shall be conducted in accordance with NFPA 72. See Annex C for TAMU acceptance test checklist.

      i. Any deficiencies noted during acceptance testing shall be corrected within 14 calendar days and a retest shall be scheduled for all deficiencies noted if not corrected during the acceptance test.

      ii. System acceptance shall be contingent upon approval by Environmental Health and Safety, Facilities Planning and Construction, and a Facilities Department representative.

      iii. Upon completion of testing, the contractor shall install the proper certification certificates in the FACP and provide a copy of NFPA 72 Record of Completion and the FML-009 Form to Environmental Health and Safety.

      iv. The contractor shall provide three (3) copies of drawings to be used during the acceptance test. These drawings shall reflect the installed device locations with device address on a floor plan representing the layout of the fire alarm system at the time of acceptance testing.
v. The contractor shall supply an electronic copy of site specific software within 14 calendar days to the TAMU/TAMUS project manager per NFPA 72.

VII. Warranty

a. The system shall be guaranteed to be free from all defects of material and workmanship for a period of one year, effective upon date of system acceptance.

b. The contractor shall guarantee parts availability for a minimum of five (5) years after installation.
Annex A

Design Submittal Requirements

All preliminary and as-built design drawings and supporting documentation shall include: Floor plan drawings, riser diagrams, control unit wiring diagrams, point to point wiring diagrams, and typical wiring diagrams as described herein.

I. Name of owner and occupant
II. Location, including street address
III. Device legend
IV. Date
V. Input/output programming matrix
VI. Licensed Designer Information – Registered Professional Engineer or Alarm Planning Superintendent (APS)
VII. Battery calculations
VIII. Notification appliance circuit voltage drop calculations
IX. Floor Plan
   a. Floor identification
   b. Point of compass
   c. Correct graphic scale
   d. All walls and doors
   e. All partitions extending to within 15 percent of ceiling height
   f. Room descriptions
   g. Fire alarm device/component locations
      i. Signal notification devices
      ii. Initiation devices
      iii. Smoke control systems
      iv. Initiation of automatic extinguishing equipment
      v. Doors that unlock or close automatically
      vi. Zone verification for detection devices
      vii. Fire/Smoke damper control
      viii. Fire alarm panel location
      ix. Fire alarm annunciators
      x. Control valves to Fire Protection System
      xi. Duct smoke detectors
      xii. Supervisory devices
      xiii. Elevator location
      xiv. Elevator recall system location
   h. Location of fire alarm primary power connections
   i. Location of monitor/control interfaces to other systems
   j. Riser locations
   k. Methods for compliance with 6.9.10.4 for survivability (emergency voice systems) as shown in section 6.9, where applicable
   l. Ceiling height and ceiling construction details
X. Fire alarm system riser diagram
   a. General arrangement of the system, in building cross-section
   b. Number of risers
   c. Type and number of circuits in each riser
   d. Type and number of fire alarm components/devices on each circuit, on each floor or level

XI. Control unit wiring diagrams should be provided for all control equipment, power supplies, battery charges, and annunciators and should include the following:

XII. Identification of control equipment depicted

XIII. Location(s)

XIV. All field wiring terminals and terminal identification

XV. All indicators and Manual controls, including the full text of all labels

XVI. All field connections to supervising station signaling equipment, releasing equipment, and fire safety control

XVII. Typical Wiring diagram should be provided for all initiating devices, notification appliances, remote light emitting diodes (LEDs), remote test stations, and end-of-line and power supervisory devices.
Annex B

Texas A&M University
Fire Alarm Reporting System Interface

All new fire alarm installations on the Texas A&M University campus shall be designed to interface directly with the dedicated fiber optics network. The network utilizes Siemens® technology to link all fire alarm systems on the campus and connect to a central monitoring station.

I. General Requirements
   A. Each new FAS installation requires a minimum ¾” conduit to be installed between the FACP and a fiber interface cabinet in the fiber network room.
   B. Wiring requirements
      1. Provide one (1) 18/2 shielded cable between the FACP and the fiber interface cabinet
      2. Provide one (1) 14/2 cable between the FACP and the fiber module in the fiber interface cabinet.

II. Panel Specific Requirements
   A. The following components are required for interfacing a Siemens XLS FACP to the campus FAS network
      1. NIC–C Network Interface Card
      2. RPM Remote Printer Interface (Provides the 485 Network)
      3. D2300CP OR D2325CPS (single mode module) Fiber Interface Module
   B. The following components are required for interfacing a Siemens MXL FACP to the campus FAS network
      1. NIM-1 Network Interface Card
      2. MOM-2 Mother Card for the NIM-1
      3. D2300CP OR D2325CPS (single mode module) Fiber Interface Module
   C. Specific components for other manufactures or Siemens panels must be verified with Siemens.
Annex C

Texas A&M University
Fire Alarm System Acceptance Checklist

<table>
<thead>
<tr>
<th>Building #:</th>
<th>Building Name:</th>
<th>Date:</th>
<th>Attendees:</th>
</tr>
</thead>
</table>

| Functional test of all Smoke Detectors | ☐ Yes | ☐ No | ☐ N/A |
| Functional test of all Heat Detectors | ☐ Yes | ☐ No | ☐ N/A |
| Functional test of all Manual Pull Stations | ☐ Yes | ☐ No | ☐ N/A |
| Functional test of all Duct Detectors | ☐ Yes | ☐ No | ☐ N/A |
| Functional test of all Flow Switches | ☐ Yes | ☐ No | ☐ N/A |
| Functional test of all Audio/Visual devices | ☐ Yes | ☐ No | ☐ N/A |
| Functional test of all Magnetic Releases | ☐ Yes | ☐ No | ☐ N/A |
| Functional test of all Remote Annunciators | ☐ Yes | ☐ No | ☐ N/A |
| Functional test of all Fireman Phones | ☐ Yes | ☐ No | ☐ N/A |
| Flow test of all Duct Detectors | ☐ Yes | ☐ No | ☐ N/A |
| dB level check on all Audible Devices | ☐ Yes | ☐ No | ☐ N/A |
| Conduct Battery Discharge Test (30 Minutes) / Full Alarm Test (General - 5 Min./Emergency Voice 15 Min.) | ☐ Yes | ☐ No | ☐ N/A |
| Verify That the Locations of All Power Supplies are Identified at FACP | ☐ Yes | ☐ No | ☐ N/A |
| Functional test of all Relays | ☐ Yes | ☐ No | ☐ N/A |
| □ AHU Shutdown | | | |
| □ Elevator Recall | | | |
| □ Suppression Systems | | | |
| □ Exhaust Fans | | | |
| □ Pressurization Fans | | | |
| Verification of Trouble Alarms | ☐ Yes | ☐ No | ☐ N/A |
| □ Smoke Detector Circuit | | | |
| □ A/V Circuit | | | |
| Verify all Supervisory Alarms | ☐ Yes | ☐ No | ☐ N/A |
| □ Sprinkler/Tamper | | | |
| □ Duct Detector | | | |
| Verify Alarm, Supervisory, & Trouble Signals Received at Radio Room | ☐ Yes | ☐ No | ☐ N/A |
| Verify Installation of Storage Box | ☐ Yes | ☐ No | ☐ N/A |
| Sensitivity Test Printout Sent to Electronic Shop Personnel | ☐ Yes | ☐ No | ☐ N/A |
| O&M Manual transferred to Electronic Shop Personnel | ☐ Yes | ☐ No | ☐ N/A |
| Transfer of any special tools to Electronic Shop Personnel | ☐ Yes | ☐ No | ☐ N/A |
| FML-009 Form Completed and Transferred to EHSD | ☐ Yes | ☐ No | ☐ N/A |
| Other: | ☐ Yes | ☐ No | ☐ N/A |
General Information

Site Clearing

Clear/grub/strip of trees, roots and vegetation that portion of the site to receive landscaping and improvements. Remove roots to a minimum depth of 24". No onsite burning is allowed unless approved by Owner. Trees/vegetation to remain shall be adequately fenced and otherwise protected from damage by construction operations.

If good friable top soil exists on site, strip this material to a depth of 4" and stockpile for reuse in areas to receive grass and other landscaping. Top soil to be free of significant vegetation, rocks or other deleterious materials.

Topsoil

Topsoil shall be a natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. It shall be obtained from approved naturally well-drained areas. Only the top 12" (inches) of earth shall be removed and used. It shall not be excessively acid or alkaline or contain toxic substances, which may be harmful to the plant growth. Topsoil shall be without admixture of subsoil and shall contain a minimum of lumps, stones, stumps, roots, or similar substances 1" (inch) or more in diameter, quality to be determined by Physical Plant Department or its representative. Topsoil shall not be collected from sites that are infected with a growth of, or the reproductive parts of, noxious weeds (Nut Sedge, Johnson grass, and Bermuda grass). Topsoil shall not be stripped, collected, or deposited while wet. It is the responsibility of the Contractor to furnish the location where the topsoil is to be obtained to FPC Project Manager or its representative in writing, as well as a one gallon sample of such soil.

Grading

Slopes of planted areas should allow easy maintenance. Turf areas shall have a slope of no more than 3:1 and no less than 1 percent. A 2 percent minimum slope is desirable. Areas with slopes greater than 3:1 must be planted with ground cover and constructed to control erosion.

Existing trees and other plant material to be preserved shall be indicated on the grading plan. Where trees are to be preserved no grading or paving of the existing grade within the drip line is allowed.

Slopes for walkways shall comply with Texas Accessibility Standards

Compact per the requirements of the Geotechnical Engineer or as a minimum compact the top 6" of all subgrade to receive embankment or paving/structural improvements to a minimum of 95% maximum density as per ASTM D-698. Open area embankment shall
be placed in maximum 12" lifts and compacted to a minimum of 90% maximum density as per ASTM D-698.

Structural embankment shall be compacted per the requirements of the Geotechnical Engineer or as a minimum compact in maximum 8" lifts to a minimum of 95% ASTM D-698. Backfill around structures shall be placed uniformly and only after the elements of the structure have attained the required strength to resist the soil pressure.

Select fill where required shall be a material available in the general area of the project (if possible) having a plasticity index (PI) ranging from 7 to 15, a liquid limit of 35 or less and being free from organic matter, large rocks or other deleterious materials.

**Excavation, Trenching and Backfilling for Utilities**

Excavation/trenching and backfilling operation shall be coordinated such that no more than 200 linear feet of trench is open at any one time. Backfilling is to be scheduled so there is a minimum amount of open excavation left during hours of no work. All open excavation shall be properly lighted and barricaded during hours that contractor is not on site. The open ends of all utility lines shall be temporarily sealed at the end of the working day.

Adequate measures shall be taken to prevent runoff water from entering the trench without damage to surrounding facilities/properties.

De-watering systems shall be provided as required for excavation/backfill activities and to allow installation of utility lines and embedment envelope on dry stable trench bottom. Discharge from the de-watering system shall be directed to drainage facilities of adequate capacity in a manner that will not damage or interfere with the use of adjoining facilities/properties. De-watering systems shall be provided at no additional cost to the Owner.

The embedment zone for a utility line extends from 6" below the bottom of a utility line to 12" above its top. Embedment material for water and sanitary sewer PVC lines shall be clean sand. Embedment material for storm sewer RCP lines is fine gradation gravel with maximum diameter of 3/4". Embedment material for pre-insulated thermal utility piping is sharp sand. Electrical duct bank is typically encased in red concrete and installed on the undisturbed trench bottom. High water table elevations may necessitate the use of an alternate embedment material and different embedment zone dimensions.

Backfill above the embedment zone for trenches in open areas shall be native material compacted in maximum 12" lifts to 90% maximum density as per ASTM D-698. Backfill above the embedment zone for trenches in areas under existing or proposed pavement or ground supported structures shall be cement stabilized sand (1 ½ sacks of cement per cubic yard of sand) compacted in maximum 8" lifts. Consolidation of trench backfill by flooding/jetting is not allowed.
An excavation/trench safety program shall be implemented which complies with OSHA trench safety standards, Subpart P. A trench safety plan shall be prepared and sealed by a Texas Professional Engineer and submitted to the Owner prior to the start of construction.

**Lime Stabilization**

If lime stabilization is required, refer to Division 32, Site Paving section.

**Termite Treatment**

When soil treatment is required all products used for the treatment of termites shall display labels bearing Environmental Protection Agency approvals and shall be mixed and applied in accordance with directions on the label.

**Void Space Below Grade Beams**

Provide soil retainers at face of grade beams below grade to form a void of sufficient depth to prevent expansion of earth to cause pressure on bottom of beams. Acceptable product is SureRetainer by MotzBlock.
General Information

Site Paving

Site paving shall be provided to facilitate pedestrian and vehicular access along with emergency and service vehicle access to the site and facility being designed.

Materials, parameters and methods shall be in basic conformance with the TxDOT “Standard Specifications for Construction of Highways, Streets and Bridges,” latest edition and applicable ASTM standards.

Subgrade material to receive pavement sections other than pedestrian sidewalks which has a plasticity index (PI) greater than 17 shall be stabilized in place with lime prior to placing the pavement. Lime shall be placed in slurry form or with Owner approval, lime may also be dry placed as Type C pelletized quicklime (grade DS). Lime shall be thoroughly mixed into the subgrade with a rotary pulverizing mixer using a two step preliminary mix/final mix procedure with appropriate curing times between mixes and compaction before opening to traffic or placing additional courses. Subgrade material to receive pavement sections other than pedestrian sidewalks which has a plasticity index (PI) less than 5 shall be stabilized in place with Type I Portland cement. The cement shall be dry mixed into the subgrade using a rotary pulverizing mixer, appropriate water added and then thoroughly mixed with the cement and soil until a full depth uniform mix has been obtained. Appropriate compaction and moist curing shall occur prior to placing additional courses. Stabilized subgrade shall be compacted to the requirements of the Geotechnical Engineer or to a minimum of 95% of the maximum density as per ASTM D-698. Stabilized subgrade shall extend a minimum of 12" beyond the supported pavement section. The amount of lime or cement to be added to the subgrade and the depth of stabilization shall be determined by the geotechnical consultant based on design mix tests and anticipated traffic loadings.

Pavement sections subject to vehicular traffic shall be either a rigid section of portland cement reinforced concrete (PCRC) or a flexible section consisting of hot mix asphaltic concrete (HMAC) surface over an approved flexible base material (coordinate pavement type selection with Owner). PCRC pavement sections shall be a minimum of 6" thick. Finish shall be broom or burlap drag. HMAC shall be Type “D” and the flexible base material shall be Type A, grade 1 or 2 as defined in the TxDOT standard specifications. A rolling pattern for HMAC shall be established using a Troxler Nuclear Density Gauge. The flexible base shall be compacted in maximum 8” lifts to a minimum density of 95% of the maximum density as per ASTM D-1557 and shall be primed with approved asphaltic material at a rate established by the team and shown on the plans prior to HMAC placement. The HMAC surface course shall be compacted to contain 3 to 8 percent air voids when tested in accordance with Tex-207-F and Tex-227-F.

The thickness of the pavement section elements shall be recommended by the geotechnical engineer based on soil conditions and anticipated traffic loadings.
Pavement at trash dumpsters, loading docks, etc. subject to heavy vehicular maneuvering and turning shall be PCRC.

Pedestrian sidewalks shall be PCRC with a minimum thickness of 4" and a minimum width of 4'. Pedestrian sidewalks that may also be service and/or emergency vehicle pathways shall be a minimum of 6” thick and appropriate width. The finish shall typically be a light broom finish but shall be coordinated with any campus standard finish schemes. Sidewalks shall be cross-sloped (max. 2%) in the direction of site drainage patterns. Sidewalks adjoining concrete curb and gutter shall be doweled into the curb and gutter section. Sidewalks adjoining foundations at doors and other points of pedestrian circulation shall be doweled to the foundation in a manner to prevent differential movement.

Concrete pavement shall typically be edged with a 6" concrete curb. Preferably the curb shall be poured monolithically with the pavement but doweled curb sections are allowed. If poured separately the curb section shall be recessed 1" into the pavement and attached with dowels of sufficient spacing and length to hold the curb firmly to the pavement.

HMAC flexible pavement sections shall typically be edged by reinforced concrete curb and gutter to receive storm drainage from the pavement and to stabilize the pavement edge. Place doweled expansion joints in curb and gutter as a minimum at end of radius returns, at curb inlets and at maximum 40' centers in straight runs. Expansion joints in curbs with adjoining sidewalks shall match the joint location and spacing in the sidewalk. Contraction joints a minimum depth of 3/4" or 1/4 slab depth whichever is greater shall be placed at 10' intervals. Curb and gutter section shall be placed on 4" of flexible base material compacted to the same requirements as the pavement section.

Reinforced concrete valley gutters shall be placed in areas of concentrated storm water runoff across HMAC pavement such as at street/driveway intersections. The valley gutter section shall be placed on 4" of flexible base material compacted to the same density requirements as the pavement section. Doweled expansion joints shall be placed in valley gutters at maximum 40' centers.

All pavement/surfaces and gutters shall be crowned and/or sloped sufficiently to positively direct storm runoff to points of discharge or collection as to eliminate ‘birdbaths’. Minimum cross slopes for open pavement areas shall be 1%; minimum crown for streets shall be 6" above the gutter line; minimum slopes for curb and gutter shall be 0.5%.

A jointing plan shall be prepared as part of the design plans showing the type and location of joints in all PCRC pavements including sidewalks and curbs/valley gutters. The expansion joints in sidewalks shall be placed at walk intersections and at maximum 20' centers in straight runs. Expansion joints, contraction joints, construction joints and isolation joints shall be placed in accordance with good engineering practice as required.
to control cracking and other distress in the concrete pavement and to facilitate construction. Concrete sawn joints shall be cut “green” using the “soft saw cut technique” as soon as the concrete hardens to support the weight of an early entry type concrete saw and operator to avoid raveling.

Concrete for all site paving/curbs/gutters shall have a minimum compressive strength of 3,000 psi at 28 days. Reinforcement shall be new deformed steel bars conforming to ASTM A615, Grade 60 minimum No. 4 bar in size. No welded wire fabric shall be used as reinforcement except in unique situations as approved by Owner. All concrete shall be adequately cured by protecting it against moisture loss for a period of not less than 72 hours beginning immediately upon completion of finishing operations and initial set of concrete.

Expansion joints shall consist of smooth bar dowel assemblies conforming to ASTM A615, grade 60 with a PVC sheath over the free end, asphalt impregnated fiber board filler and cold applied self leveling polyurethane sealant with closed cell polyethylene backer rod.

The basic configuration of parking lots shall be as follows:

- Parking Angle: 90 degrees
- Stall Width: 9’ - 0”
- Module Width: 62’ - 0” (stripe to stripe), 60’ - 0” (face of curb to stripe), 58’ - 0” (face of curb to face of curb)
- Drive Aisle: 24’ - 0”
- Stripe Width: 4”
- Stripe Length: 18’ - 0”

- Landscaped Medians: Planted with low profile vegetation, irrigated, and spaced appropriate to the design.
- Concrete Mow Strips: 2'-0" wide back of curb for head-in parking when no wheel stops are provided
- Lighting: 0.9 foot candles

**Concrete Walks**

Concrete sidewalks width shall be sized to handle pedestrian flow.

Concrete sidewalks are generally medium broom finish.

Avoid surface drainage of storm water across sidewalks.
Bicycle Racks

Show bicycle racks in sufficient quantity near but not in front of entrances. Use standard ribbon hot dipped galvanized pipe type embedded in concrete.

These details shall be incorporated in the drawings. The number of racks required will be determined during the schematic design stage with the FPC Project Manager.

Trash Removal

Trash receptacle location should be at grade level and should be placed so that they can be loaded from top as well as side and screened from public view. Verify method of disposal at various research centers/stations and other Universities.

Receptacle area should be adequately lighted for night use.

At dumpster locations, provide a concrete pad of sufficient size and strength to accommodate the dumpster and truck.

Porches and Steps

All stoops, porches, docks and steps, exterior and interior should have built-in abrasive surfaces. Slope exterior porches and treads to drain water 1/4” per foot. Exposed concrete finished work shall be accomplished in two pours: the first structural and the second being a two inch minimum finish topping poured near completion of project. WTAMU prefers a single pour system, to avoid potential freeze thaw damage. Primary entry floors may be constructed using brick, tile, pavers or other permanent floor materials.

Landscaping

All landscaping plantings shall be planned and designed to be compatible with the overall campus landscaping scheme. Emphasis shall be placed on durability and low maintenance characteristics.

Planting Mixture- Premixed blend of topsoil, organic matter, and sand in a ratio suited for the area and plant material specified. Seasonal color beds shall have 2” depth of peat moss tilled into top layer of planting mix before installation of plant material.

Planters- 12” Minimum of planting mix placed in planter. Crown surface for drainage.

Turf Areas- 3-4” of topsoil placed and fine graded before placement of turf.

Concrete Mow Strip- Planter areas that are adjacent to turf areas shall have a 12” wide
x 4” thick, reinforced concrete mow strip. Reinforcing shall be No. 3 rebar. Medium broom finish. Concrete shall be 5 sack mix, 3000 PSI at 28 days, minimum. Adjacent to building the mow strip shall be minimum 24” wide with an expansion joint and not doweled to the building foundation.

All disturbed areas shall be graded to properly drain and seeded or sodded with a permanent grass.

Sod- Sod shall be variety approved by the campus representative. Sod shall be composed of certified, approved, or nursery grown grass and shall be true to name/variety. Sod shall be substantially free of noxious weeds, disease, insects, thatch and undesirable grasses. Sod shall have a sufficient density so that no surface soil is visible at a mowing height of 1.5 “(inches). Sod shall be neatly mowed and mature enough that when grasped at one end it can be lifted and handled without damage to the sod. Maximum mowing height shall be 2.5 “(inches).

Sod shall be cut to provide a sufficient root zone and stand of live grass. Sod shall be cut with a uniform soil portion of a ½” thickness, plus or minus ¼ inches.

Sod shall be cut, delivered and installed within 24 hours of cutting. Sod shall be cut by mechanical means such as sod cutters. Sod shall be cut when the moisture content (either excessively wet or dry) will effect the lifespan of the sod.

Area to designated for sod, shall fine graded, smoothed, with topsoil placed before final grading. If soil is dry, lightly moisten before placement of sod.

First row of sod shall be placed in straight line with additional placement of rows shall be parallel and tightly placed against each row. Staggered lateral joints butted tightly shall be used. Sod shall not be stretched or overlapped.

Sod on slopes greater than 3:1 shall be placed perpendicular to slope. Sod on slopes shall be temporally fastened to ground by stakes, staples, pegs or other approved methods. After sod has become established, contractor shall remove fasteners.

Sod shall be lightly rolled after section is placed. Once sod has been placed, immediately water sod to prevent excessive drying. Thoroughly water sod so that underside of sod and soil are completely wet.

**Irrigation**

Design and installation must meet TCEQ (Texas Commission on Environmental Quality) irrigation laws and requirements. Irrigation systems shall be installed under the supervision of a Licensed Irrigator.

The irrigation system shall be positively separated from the domestic water system by a
double check or reduced pressure type backflow preventer meeting the requirements of AWWA C506. Type chosen shall be suitable to the installation location and conditions. Backflow preventers may be placed in the mechanical space of the building when appropriate. Double check valve backflow preventers located in the landscape, when placed underground shall be in valve boxes or vaults with adequate room for testing. Backflow preventers placed above ground, should be located to minimize visibility, and or concealed with plants or landscaping features to maintain aesthetics.

Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves. Extend sleeve ends 24” beyond the edge of paved surface. Mark sleeve location with 3/8” X 3” brass or stainless steel stove bolt embedded in the concrete at each end. Slewing pipe beneath pedestrian pavements shall be PVC Class 200 with solvent welded joints. Slewing pipe beneath drives and streets shall be Schedule 40 with solvent welded joints. Sleeves installed under pavement for future irrigation installation shall be loose capped on each end and marked with stove bolts as above. Size and depth of sleeve should be coordinated with the landscape architect, with a minimum size being 4”.

Mainline and lateral pipe shall be PVC Class 200 and have bell ends. Mainline and lateral fittings shall be PVC Schedule 40. All PVC pipe and slip fittings shall be joined with primer and solvent cement. Cure time for cement should be in accordance with manufacturer’s instructions. For threaded PVC connections, use only Teflon-type tape. When connection is PVC to metal, the PVC component shall have male threads and the metal component shall have female threads.

The satellite irrigation controllers should be located outside the building or as directed by the Facilities Department. Controller units shall be compatible with the existing campus controller system. For controller, provide quick disconnect from power source next to controller.

Electric wire from the satellite controller to each remote control valve and the common wire shall be AWG No. 14 solid copper, type UF cable, UL approved for direct underground burial. Wire color should be continuous over its entire length. Use white for common ground wire. Use easily distinguishable colors for other control wires. Control wire splices shall be made with 3M-DBY or equal direct burial splice kit. If multiple splices are made in one location, splices are to be placed in a valve box. Install a control wire from controller to each remote control valve. Multiple valves on a single control wire are not permitted. Control wires shall be in same trench as constant pressure lines. Provide an isolation valve for each zone; however, it is acceptable to install 2 zones to an isolation valve if necessary. Remote control valves shall be placed in valve boxes.

Remote control valves and irrigation heads should be compatible with existing campus irrigation system. Head to head spacing is required. Spacing must not exceed manufacturer’s recommended spacing. All heads shall be adjusted to factory specifications.
Excavated material is generally satisfactory for backfill. Backfill shall be free from rubbish, vegetation, frozen materials, and stones larger than 2 inches in dimension. Backfill placed next to pipe shall be free of sharp objects which may damage the pipe. Contractor shall be responsible for adding soil to trenches after settling has occurred.

Upon completion of work, remove from the site all tools, excess materials, and rubbish.

Contractor shall provide a demonstration and walk through of entire irrigation system with Owner and Owner’s Representative.

Contractor shall supply record drawings (“as built”) of all irrigation as installed in ground to Owner or Owner's representative. Zones, back flow preventer, and controllers as well as the zone flow measurement for each zone shall be included and shown on the drawings. Drawings shall be at a scale no smaller than one inch equals thirty feet. Drawings shall be sealed, dated and signed by licensed irrigator in the State of Texas. Operation manuals for controller and other irrigation equipment shall be submitted at time of record drawings.

Campus Specific Information

Texas A&M University

Trash Removal

Front loading trucks used at TAMU and TAMUG.

Irrigation Materials

Spray Heads - Up to 17’ Radius, Lawn and Shrub Areas
Toro 570 Series with pressure compensating device (PCD)
Shrub heads shall be 6” or 12” Hi-Pop Body. Turf areas shall be 4” Hi-Pop Body.

Rotary Heads-
Hunter PGP
Hunter I-40

Electric Control Valves
Rainbird PEB Series

Gate Valves- Brass
Ball Valves - PVC
Quick Coupling Valves
Rainbird #44

Back Flow Preventer-
Double Check Valve
½” to 2” Febco 805Y or equal
2 ½” and greater Febco 850 or equal

Fittings-
Lasco or equal

Wire-Direct Burial Wire
Connectors- 3M – DBY or equal

Valve Boxes-
AMTEK or Equal

Plant Materials

Trees

- Texas Red Oak
- Shumard Oak (non irrigation)
- White Oak
- Bur Oak
- Easter Red Cedar
- Nutall Oak
- Live Oak
- Monterey Oak
- Cedar Elm
- Pecan
- Chinese Elm
- Bald Cypress
- Pond Cypress
- Monterey Cypress
- Texas Mountain Laurel
- Crepe Myrtle
- Aristocrat Pear
- Mexican Plum
- Texas Pistache
- Chinese Pistache
- Golden Rain Tree
- Texas Ash
- Texas Persimmon
- Texas Redbud
- Mexican Redbud
- Elderica Pine
- Bradford Pear
- Western Soapberry
- Japanese Yew (by building)

Shrubs

- Indian Hawthorn
- Dwarf Yaupon
- Dwarf Burford Holly
- Burford Holly
- Green Texas Sage
- Sliver Texas Sage
Mediland Rose  
Knock Out Roxe  
Oleander  
Dwarf Chinese Holly  
Chinese Photinia

Groundcover

<table>
<thead>
<tr>
<th>Liriope</th>
<th>Creeping Lantana</th>
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<tbody>
<tr>
<td>Big Blue</td>
<td>Lantana</td>
</tr>
<tr>
<td>Silvery Sunproof</td>
<td></td>
</tr>
</tbody>
</table>

| Liriope Spicata | Sliver Dragon | Giantea |
| Asiatic Jasmine | Dwarf Asiatic Jasmine | Confederate Jasmine |
| Carolina Jessamine | Creeping Euonymus |

Tarleton State University

Site Furnishings

Public Areas Benches- The Public area benches shall be constructed of all weather Pea Gravel aggregate stone sides with Powder coated Bronze preferred colored expanded fluted metal Seating and back rest. The expanded metal should be fluted/slotted style for public areas only. Final aggregate color to be coffee Bean (see www.upbeat.com for examples. Item# CKSCBEN6) Public areas would be defined as the Thompson Student Development Building, The Administration Building, The Trogdon House, Fine Arts Building, Mall areas, Band Stand, Military Memorial, visitor Center...ect..

Trash Receptacles aggregate and slotted metal should match the public area benches as well. Available colors are Black or Brown (bronze preferred if available) metal color should match with the bench color as well. (see www.upbeat.com for examples. Item# TSS) Aggregate color to be coffee bean.

Intermediate Campus area Benches - 6’ wide metal slotted bench with Cast iron ends Item # L1360  Bronze color The Intermediate area benches shall be constructed of Cast Iron ends with plastisol coated steel rectangular steel slats with high gloss powder coat finish. These benches should be utilized throughout the general areas of campus. (not in highly public areas or off the beaten path)
These would be installed in and around front entrances the general classroom type buildings such as the O.A Grant Building, The Math Building, The business Building, ect. (see www.upbeat.com for examples. Item# L1360)

**General Campus 5’ wide metal bench** (Lower cost General campus bench) Item # L2010 The general area benches shall be constructed of rectangular steel tubing with high gloss powder coat finish. These benches should be utilized throughout the general off the beaten path type areas of the campus. (not in highly public areas or up against the main entrances areas of building. These benches will make great sidewalk pathway benches as well as backsides of buildings not regularly utilized by the public. (see www.upbeat.com for examples. Item# L2010)

**Trash Receptacle 32 gallon** (see www.upbeat.com for examples. Item# L1378) This trash receptacle is constructed of Plastisol coated steel slats. Color Bronze Lid shall be see www.upbeat.com item# #3202 bronze color.
(Note: This Trash receptacle shall be used with all the benches except “Public area benches” which have aggregate sides).

**Prairie View A&M University**

**Concrete Walks**

Concrete sidewalks on the Prairie View A&M University campus should make maximum use of exposed aggregate finishes such as in the quadrangle landscape area.

**Texas A&M University-Kingsville**

**Trash Removal**

Side loading trucks are used at Texas A&M University-Kingsville

**West Texas A&M University**

**Trash Removal**

Rear loading trucks are used at WTAMU, there are no dumpsters.
General Information

All connections to campus utility distribution systems or public utilities shall be accurately located by dimensions or coordinates. Depth of piping shall be shown and inverts must be shown at manholes and other critical points.

All site utilities shall be included as part of the BIM(s). They shall be shown accurately in terms of size, depth, and location.

Sanitary Sewerage Utilities

Gravity sanitary sewer mainlines shall be no less than 6" and services lines shall be no less than 4". All gravity sanitary sewer piping shall be SDR 26 PVC (ASTM D 3034) or heavier. Exposed piping shall be ductile iron with appropriate coating protection. PVC and ductile iron piping shall have watertight push-on joints using elastomeric gaskets meeting the requirements of ASTM F 477 and AWWA C111 respectively. Fittings shall be of equal strength as the piping. Appropriately spiced and terminated tracer wire or aluminum tape shall be laid with all non-metallic sewer piping.

Manholes are required for all horizontal and vertical bends as well as changes in pipe size. Manholes on sanitary sewer mainlines shall be spaced no further than 350 feet apart and be placed at all piping intersections and angle points with the exception of 4" service lines. Appropriate wye fittings shall be used at such service connections. Sanitary sewer manholes shall be either cast-in-place or pre-cast (ASTM C478) with a reinforced concrete base. Minimum 28 day concrete strength shall be 3,000 psi. Manholes shall be placed on 9" of 1-1/2 sack cement stabilized sand. The invert of the manhole shall be sloped and smooth finished sufficiently to prevent deposition of solids. If the elevation difference between an entering pipe and the exiting pipe is more than 2 feet, a drop type connection to the manhole shall be used. Manhole construction and testing shall be in accordance with TCEQ requirements.

Sanitary sewer and storm sewer shall be shown on separate sheets along with profiles.

All pipes penetrating exterior walls or foundations of buildings below grade must be installed properly with sleeves to prevent breakage due to building settlement or expansive soil.

Provide 30 inch diameter minimum size access openings for all sanitary manholes.

Cleanouts shall be provided for all service laterals and be located at the building and at each bend. Cleanouts shall be installed on all 4" sanitary sewer service lines as required to facilitate line cleaning.

Profiles on sewer lines shall be shown for all pipe sizes. The profiles shall show as a minimum, depth of cover, other utility crossings with verified elevations, slope, inverts,
Design Criteria
Division 33 – Utilities

pipe material and class of pipe.

Sanitary sewer lift stations shall consist of precast (ASTM C478) or cast-in place reinforced concrete wet well containing a heavy-duty duplex pumping system readily accessible/removable for replacement/maintenance. A lockable hatch system of adequate size for maintenance/access shall be provided. A reliable level control system shall be provided to start/stop the pumps including a high level alarm. The basic control system shall consist of a remote disconnect, combination starter for each motor, H-O-A switches, visual and audible high level alarm, run lights and seal failure sensors. All Conduit connections to the wet well will be adequately sealed to sewer gases/moisture. Pump discharge piping for each pump shall be flanged ductile iron containing a check valve and plug valve located in a valve pit exterior to the wet well. Metal surfaces inside the wet well and the inside surfaces of the wet well shall be protected by appropriate coatings. Valve pit shall have a lockable hatch of adequate size for operation and maintenance of valves.

Sanitary sewer force mains shall be SDR 21 PVC complying with ASTM D2241. All fittings shall be of equal Class and pressure rating as pipe. All angles, bends, tees, etc. shall be stabilized with concrete thrust blocks, sized by the Project A/E. All non-metallic force mains shall have aluminum detector tape 12” placed below final grade.

The sanitary sewer system shall be designed, installed and tested in accordance with Texas Commission on Environmental Quality (TCEQ) requirements. Leakage test on PVC pipe shall be a low pressure air test performed as set forth by the Uni-Bell PVC Pipe Association. Deflection tests shall be by a mandrel pulled 30 days following trench backfill. All tests shall be witnessed by the Owner.

Storm Drainage Utilities

Storm sewer shall either be RCP Class III (ASTM C76) for 12" and above or SDR 26 PVC (ASTM D3034) or heavier for less than 12". RCP joints shall meet ASTM C443. PVC pipe shall have water tight push-on joints meeting the requirements of ASTM F477.

Storm roof drains shall be run separately from all other storm water sources to the outside of the building.

Both sanitary and storm sewers sizes shall be determined by a Texas Professional Engineer (PE) and is to be based on existing/future sewer capacities and a drainage study for storm sewers. If the existing infrastructure cannot accommodate the increased loads, then an estimate shall be presented to the Owner to determine if additional funds need to be appropriated for any up-sizing.

Manholes and/or junction boxes with access openings shall be installed on the storm sewer system at all piping intersections, changes in slope and angle points with the exception of small drain leads which may use appropriate wye fittings. Manholes shall
be either pre-cast (ASTM C 478) or cast-in-place with a reinforced concrete foundation. Junction boxes shall be of reinforced pre-cast or cast-in-place construction. Minimum 28 day concrete strength shall be 3,000 psi. Foundation for manholes and/or junction boxes shall be on 1-1/2 sack cement stabilized sand.

Provide 30 inch diameter minimum size access openings for all manholes. Iron castings for manhole rings and covers shall conform to ASTM A 48, Class 30 and be traffic rated.

Area inlets for the storm sewer system shall be either pre-cast or cast-in-place reinforced concrete with frame and grate iron castings conforming to ASTM A48 Class 30 and shall be traffic rated. Curb inlets shall also be either pre-cast or cast-in-place with a manhole frame and cover installed in the top to allow access. In high visibility areas near buildings or at pedestrian drop off points, inlet tops shall be cast-in-place. Minimum concrete 28 day compressive strength for inlets shall be 3,000 psi. Typically storm sewer discharge points shall be stabilized with either a pre-cast or cast-in-place headwall structure with adequate surrounding rip-rap to control erosion. Minimum concrete 28 day compressive strength for headwalls shall be 3,000 psi.

**Water Utilities**

The domestic water system shall be designed and installed in accordance with TCEQ requirements.

Domestic water piping 4” to 12” shall be AWWA C-900 or AWWA C-909, Class 200 PVC with elastomeric gasketed push-on joints. Domestic water piping larger than 12” shall be AWWA C-905, Class 200 PVC with elastomeric gasketed push-on joints. Fittings shall be cement mortar lined and appropriately coated and protected mechanical joint ductile iron. Piping smaller than 4” shall be SDR 21 Class 200 ASTM D2241, PVC with elastomeric gasketed push on joints. Fittings shall be PVC of equal strength.

All angles, bends, tees etc. shall be stabilized with concrete thrust blocks sized by the Project A/E. Appropriately spliced and terminated tracer wire or aluminum tape shall be laid with all non metallic water line.

Line valves shall be placed at all points of connection to existing water lines, at branch intersections and any other location necessary for adequate control of the water system. Typically the number of valves at an intersection will equal the number of branches less one. “In line” valves shall be placed in long runs of pipe at approximate 2000 foot spacing. Adequately supported air/vacuum relief valves shall be installed as required along the main in enclosures to facilitate draining and maintenance/inspection.

Line valves 3” and larger shall be direct bury resilient wedge gate valves meeting the requirements of AWWA C509 with mechanical joint connectors and non rising stem nut operator. Valves shall be poly wrapped in accordance with AWWA C105. All valve operators shall open when turned counterclockwise and close when turned clockwise.
Line valves smaller than 3" shall be bronze body ball valves with threaded connectors, stainless steel ball and stem, lever operated with a rated working pressure of 200 psi.

Cast iron adjustable valve boxes with surface reinforced concrete collar shall provide over all buried valves to provide access from ground surface to valve operating nut.

Adequate fire hydrants shall be placed around the facility such that no portion of the building is over 300 feet from a hydrant. Fire hydrants shall be 5 1/4" main valve opening with 2 ~ 2-1/2" hose nozzles and a 4 ½" pumper nozzle. Coordinate nozzle size and thread requirements with entity providing fire protection. Hydrants shall be dry-top compression type hydrants, traffic model, complying with AWWA C502. Auxiliary gate valves shall be placed in all hydrant leads.

Where necessary, connections to existing water mains shall be a “hot” tap using a tapping sleeve and valve appropriate to the type of pipe being tapped. No full size taps shall be made without approval by the Owner.

The domestic water supply to a facility shall be metered unless directed otherwise by the Owner.

The complete site domestic water system installed for the project shall be pressure tested for leakage in accordance with TCEQ requirements along with applicable fire protection codes and shall be disinfected in accordance with the requirements of AWWA C601.

All waterlines shall have an aluminum detector tape placed 12" below final grade.

**Concrete Utility Boxes**

Concrete boxes required by the mechanical, plumbing, civil site work and/or electrical divisions must be properly dimensioned, reinforced and/or detailed.

Chilled water and heating water valves in underground systems shall have as an enclosure a concrete valve box with sufficient space to maintain and operate valves. Direct buried valves may be considered if acceptable to the System Mechanical Engineer.

**Chilled and Heating Water Distribution**

Chilled water and heating water distribution piping shall be pre-insulated ductile iron. All straight section shall be factory insulated. Fittings and joints shall be provided with field insulation kits compatible with the factory insulation. The insulation shall be protected by an HDPE outer shell. Pipe shall be listed suitable for use with 43 degree chiller water and 180 degree heating water. Ductile iron pipe shall be Class 50 thickness, restrained joint conforming to ANSI A 21.512 or AWWA C 151-75. Pipe and
fittings shall be cement lined and have an external bitumastic/tar coating and no internal coating. Pipe and fittings shall be U.S. Pipe TR FLEX or Clow Super Lok.

Spacing between chilled and heating pipes should be at least 10 – 12 inches.

Direct burial of steam piping is not acceptable. Some form of concrete or metal duct shall be provided.

Use Cor-ten© bolts or corrosion resistant alloy bolts on underground piping especially heating water piping.

All underground direct buried valves shall be ductile iron butterfly with a "Ground Hog" gear box.

**Campus Specific Information**

**Texas A&M University**

**High Density Polyethylene (HDPE) Piping Installations**

The Project A/E shall refer to Utilities & Energy Services – Design Standards & Guidelines for additional information. This can be found at https://utilities.tamu.edu/design-standards/

**Manhole Covers**

The Project A/E shall refer to Utilities & Energy Services – Design Standards & Guidelines for additional information. This can be found at https://utilities.tamu.edu/design-standards/

**Medium Voltage Electrical Equipment**

The Project A/E shall refer to Utilities & Energy Services – Design Standards & Guidelines for additional information. This can be found at https://utilities.tamu.edu/design-standards/

**Manholes**

The Project A/E shall refer to Utilities & Energy Services – Design Standards & Guidelines for additional information. This can be found at https://utilities.tamu.edu/design-standards/
Exterior Site Lighting

The Project A/E shall refer to Utilities & Energy Services – Design Standards & Guidelines for additional information. This can be found at https://utilities.tamu.edu/design-standards/
General

The Design Process described in this section is primarily for Construction Manager at Risk and Design-Build delivery process. Items specific to Competitive Sealed Proposal or other delivery methods are so noted.

Integrated Design

Representatives from all parties to the design and construction of the project, the Architect/Engineer team, the Contractor team, the A&M System Member team and the FPC team are expected to work very collaboratively and openly sharing information, including but not limited to BIMs, knowledge and experience from the beginning of Schematic Design through the completion of construction. Representatives from all teams and all disciplines are expected attend and actively participate in all design meetings.

Overall Design Process

Using BIM in the design process means that there are several are quite a few issues that need to be set up day one of the design process and remain in place and consistent throughout the process, into construction, and closeout.

Using BIM with most delivery methods results in a very linear process, as outlined in the following diagram.

The delivery methods we will focus on here is Construction Manger at Risk (CMAR). This process is more collaborative and gives the Construction Manager more input during the design process. Take some time to review the following diagram.
Using BIM means that most decisions on how to set up the project have to be made early on in the process. The following is a summary of many of the issues that need to be implemented or set up early on.

- File/folder naming is important to the organization of the files and sets up the methodology for file archiving.
  - The models being generated are to be used on future projects. The model files should be transmitted in both the native file format of the BIM authoring software as well as optimized IFCs. Free IFC optimizers are available on the internet. See www.solibri.com for an example of one.
  - Each drawing sheet should be delivered in both DWG as well as PDF formats.
  - Specifications should be delivered in both Word Doc format as well as PDFs.
  - All files shall be delivered in the proper location as set up in the folder layout which is to be distributed via FPC’s website. See the following illustration.
- Set the A/E is to set the project origin. This origin shall be the same for all models. The origin shall relate to a real world survey datum.
- The elevation shall be set according to the real world elevation. That is if the 1st floor elevation is at 230.00’ above sea level then the first floor elevation in the model should be the same.
- Models should be split vertically and not horizontally.
- All consultants shall produce BIM models. This includes civil.
- The survey of the model shall also be produced using BIM authoring software. The location and elevation of the utilities shall be indicated on the drawing and modeled.
- The A/E shall work with the owner’s team to set the stratification of equipment in the ceiling plenum.
- The A/E shall work with FPC’s project manager to establish the project’s abbreviated name. For instance the Corp Dorm Renovation project may be known as CDR or the Memorial Student Center Renovation project may be known as MSC.
- The A/E shall work with FPC’s project manager to establish room numbering standards and methodologies. This shall remain in place throughout the project so is should not be taken lightly.
• Room area shall be established and updated throughout the project by using standards established by The Higher Education Coordination Board (THECB).
• All equipment that requires access after construction is complete shall have the required clearance modeled along with the equipment.
• All equipment shall be named using an easily identifiable naming standard such as those set forth in the National CAD Standard V4.0. For instance an air handler unit's family or object name should start out with something like AHU then go into more description.
• Equipment objects shall have the minimum parametric attributes:
  o Location, that is room number in which or above which the piece of equipment is located.
  o Manufacturer, at the beginning of the project this is the basis of design manufacturer established by the A/E. In a CMAR project the CM may help to establish the manufacturer that is most likely to be used. This information shall be updated by the CM and its subs.
  o Model number. Again this is based on design intent set by the A/E at the beginning of the project and finalized by the CM at the end of the project.
  o Any pertinent design criteria such as CFM, voltage, watts, volume, velocity, etc. This again is information that shall be updated by the CM and its subs and later by the commissioning (Cx) team.
• Models should be shared frequently by all members of the team. This includes the CM and their subs. Sharing should occur daily if not more frequently to ensure that realtime coordination is occurring.
• All efforts shall be taken to reduce the amount of duplication between disciplines. This is more prevalent amongst the A/E team. For instance the architect may show the location of lights then the electrical engineer will show the location of lights but the architect does not remove them from their model. This causes collisions to occur and also raises questions by the CM and its subs as to which lighting layout is correct. By sharing the various models and using them in addition to the file in which one is working helps to eliminate this sort of problem.
• All trade information shall be contained in a single model not split into multiple models by floor. For instance there should be one model identified as the electrical model. At the beginning of the project this model will belong to the electrical engineer but will then transition to the electrical sub. The model should stay intact as one model and not split into multiple floors. If file size becomes an issue it is preferable to split the building vertically and not horizontally. This split should be consistent through all trades if required.
• All project schedules shall be linked to the model and be generated using parametric data from objects in the model. This link shall remain throughout the project.
• Basic sun shading analysis shall be used to aid in the siting and massing of buildings to help produce efficient buildings that respond to the demands of their geographic location.
• The A/E is required to do clash and collision detection and submit reports addressing the issues found. These reports and models are required at each milestone of the project. Each report shall not be the first run of the report at the milestone. The A/E is required to run the report prior to the due date to address major issues and any
false positives that may be found. In the CMAR process the CMAR will be responsible for working with the A/E to run the reports. It is understood that reports run during Schematic Design will generate little data that is they should generate little data.

- The MEP consultant is required to have a person that is responsible for the coordination and design of the various disciplines at coordination meetings not just one overall project manager.
- The BIMs should be used to generate quick images for use in explaining the spaces to the clients. Elaborate renderings are not always required.
- The model files shall be transmitted with object/family and IFC libraries.

**Programming and Space Verification**

The use of BIM allows us to create and verify program and programmatic requirements. This also means that the following parametric information must be associated with spaces/zones to be able to extract and compare it to the program. The data may also be used later for submission to THECB. Use BIM to assign and then extract the following parametric data from the model and compare it to the program:

- Room names
- Room numbers
- Room occupancy type
- Room maximum occupancy number
- Departmental information associated with spaces. All spaces shall be assigned a department. The department may also identify circulation and mechanical spaces as well.
- Floor/level of all rooms and spaces
- Three digit room type codes
- Two digit room use code
- Two digit part of system code
- All departmental spaces shall be assigned a color. This color should be the same as that assigned to associated degree type. For instance Architecture is a lavender color and philosophy is blue.
- Square footages of:
  - Rooms (Net)
  - Departmental spaces
  - Overall square footages by floor
  - Circulation area
  - Unassignable area

Square footages and room type codes of spaces should be determined using standards set forth by THECB and the Facilities Inventory and Classification and Procedures Manual distributed by Texas A&M University Office of Facilities Coordination or the appropriate document issued by the member university.

**Schematic Design**
The A/E team and the Contractor team shall make professional evaluations of design problems and issues related to this project, analyze the advantages and disadvantages of each evaluation, and recommend cost effective solutions in the Schematic Design phase. The A/E is responsible for the design and arrangement of building components and spaces to provide aesthetically pleasing and functional spaces for the university or agency. Detailed studies by the A/E and Contractor will be required during this design phase to establish the most economical and efficient use of the site, use of materials and construction methods in order to accomplish the System Member’s requirements for the project within the approved budget.

It is anticipated that several meetings involving all participants from the A/E team, the Contractor team, the System Member team and the FPC team will be required to develop a design that satisfies the Program of Requirements within the project budget.

For a typical building project the first Schematic Design meeting will explore possible ways to place the building on the site and begin to explore the building mass. Use software to perform day lighting analysis of the buildings. Be sure to take into account obstructions that will cast shadows on the building(s). Prepare massing studies to compare at least three massing schemes. Other Schematic Design meetings will explore arrangements of the individual spaces, including required support spaces, massing and building elevations. The FPC Project Manager shall receive a copy of all presentation materials a minimum of two (2) days prior to each of these Schematic Design meetings. Each Schematic Design meeting may involve multiple presentations to various groups and committees. Refer to the FPC Project Manager for specifics of each Schematic Design presentation.

Drawings for these first Schematic Design meetings can be in rough form, such as butter-paper sketches, since revisions will probably occur. Computer imaging and modeling is encouraged. Hardcopies of all concepts to be presented are required. All members from the A/E team and the Contractor team shall be present and participate at these meetings.

At each of these Schematic Design meetings the Project A/E shall prepare and present a minimum of three (3) different schemes. At the end of each of the meetings the Project A/E will have a direction from the Owner and User as to a design direction for the next Schematic Design meeting.

The final Schematic Design review meeting will determine the arrangements of all building spaces as well as the exterior appearance of the building. The final Schematic Design review meeting will occur a minimum of one (1) week after the submission of all required materials.

The AE and CM shall review construction sequencing. Once the sequencing has been established the AEC shall review and establish any special drawing packages that will be required to begin construction in a timely manner. The drawings required for each
package shall be reviewed and documented to ensure that the required drawings are completed and submitted when they are needed.

These early design meetings are a good time for the AEC to review any special project requirements or layout of equipment. For instance the team shall establish a preliminary ceiling plenum stratification strategy by which the AE shall stack building services in the ceiling plenum or leave clearances for ceiling mounted equipment.

A component of Schematic Design will be, in conjunction with the contractor on CMAR and D-B projects, to identify an early release drawings and specifications that can be ready for construction after the approval of the GMP.

Some projects may be able to accomplish Schematic Design in fewer meetings; other projects may take more meetings. The A/E will not proceed to Design Development until all requirements for Schematic Design have been satisfied and approval of Schematic Design has been received.

**Minimum Requirements for final Schematic Design Submittal**

**Drawings**

**General**

- All sheets shall have a text scale and graphic scale.
- All applicable sheets shall have a north arrow in a consistent orientation.
- If the site plan(s) and/or floor plan(s) is divided over multiple sheets then a key map near the title block is required.
- Plotted sheet size cannot exceed ANSI E Size Sheet (34” by 44”)
- All text shall be minimum 1/8” when plotted to full size. Text will then be legible on half size sets of drawings.

**Hazardous Materials**

- Plan(s) showing location of hazardous materials found during survey.

**Civil**

- Site plan(s) at the same scale and orientation as the architectural site plan showing existing and new vehicular and pedestrian circulation, existing and new civil utilities, site drainage areas and calculations of runoff, existing and new contours, existing and new site features, limits of construction and construction staging area.

**Landscape**
Site plan(s) at the same scale and orientation as other site plan(s) showing existing and new planting, existing and new irrigation zones and other site features.

Structural

- Floor plan of all levels showing column grid, preliminary location of beams with sizes, location of openings and shear walls and floor depressions.
- Preliminary foundation plan
- Preliminary roof framing plan showing major roof slopes.

Architectural

- Architectural site plan showing all existing and new site features as well as limits of construction and construction staging area.
- Floor plan of all levels showing fire walls, hazard level occupancies and travel distances.
- Floor plan of all levels showing room names, capacity information (occupancy), relative wall thicknesses, door swings, fixed casework and equipment, floor elevation, column grid, wall fire ratings, travel distances.
- Floor plan of all areas showing room names, preliminary furnishings and movable equipment, indication of floor and wall finishes.
- All elevations showing materials, floor elevations, fenestration, exposed mechanical and electrical equipment, finish grades and significant site features.
- Major building sections showing relative thickness of floors and walls, floor elevations, finish grades, room names, and significant mechanical and electrical equipment.
- Exterior and interior perspectives and/or animations to illustrate design.

Equipment

- Floor plan of typical laboratories showing laboratory casework and laboratory equipment.

Plumbing

- Floor plan of all levels showing all plumbing equipment and preliminary routing of main horizontal and vertical runs.

Mechanical

- Site plan(s) at the same scale and orientation as other site plan(s) showing existing and new thermal and gas lines as well as limits of construction.
- Typical enlarged mechanical room plan showing equipment and required maintenance access.
Electrical

- Site plan(s) at the same scale and orientation as other site plan(s) showing existing and new electrical distribution as well as limits of construction and construction staging area.
- Typical enlarged electrical room plans showing equipment and code required access.
- One line diagram of electrical system.

Telecommunications

- Site plan(s) at the same scale and orientation as other site plan(s) showing existing and new telecommunications, data and cable television distribution as well as limits of construction.
- Floor plan showing typical means of cable distribution.
- Typical enlarged data/telecomm room plan showing equipment and access.
- Typical enlarged plans showing location of audio-visual equipment.
- One line diagram of data, telecommunications, broadband distribution and audio-visual systems.

Reports

Reports shall be on letter size paper and all bound together in a three-ring binder or spiral bound. All reports shall also be delivered in PDF format as well as Microsoft Word format.

Basis of Design

The Basis of Design is a narrative description of the project containing the basic information, criteria, logic, major decisions, evaluations and considerations developed in the following applicable categories to prepare the Schematic Design submittal.

- Hazardous Materials Survey Narrative
- Civil and Landscape Design Narrative
- Structural Design Narrative
- Architectural Design Narrative
- Mechanical Design Narrative
- Plumbing Design Narrative
- Electrical Design Narrative
- Data/Telecommunications Design Narrative
- Audio Visual Design Narrative
- Sustainable Design Narrative using LEED 2009 Checklist
- Listing and size of spaces comparing POR with Schematic Design
Cost Estimate

- Cost estimate in MasterFormat 2012 format.

Completion of Schematic Design

Completed final Schematic Design documents are a result of a completed product and are not a function of time or duration of work.

Final Schematic Design documents that are “on average” 100% complete are not acceptable.

Upon completion of Schematic Design the following are established

- The project scope, form and spatial relationships are defined.
- The selection and initial design of major building systems such as exterior envelope, structure, mechanical, plumbing and electrical are finalized.
- A preliminary construction schedule is established.
- The project as defined is achievable within the established Amount Available for the Construction Contract based on continuous input from the Construction Manager at Risk.
- An early release package is identified on CMAR and D-B projects.

Design Development

The approved Schematic Design shall be developed into Design Development documents sufficient to fully reveal all aspects of the project. This will include all items to meet the System Member's needs, and development of all facility components to fully illustrate the proposed aesthetics, construction, systems, utilities, services, and accessories.

Between the Schematic Design approval and the submission of Design Development most projects will require various meetings to identify the full requirements for basic components of the design as well as special or unique components such as data/telecommunications, audio visual systems, security systems, food service requirements, laboratory design, etc. It is anticipated that these meetings will occur, at a minimum, monthly.

Results of these meetings must be documented in a narrative describing systems and identifying the scope that will be in the project.

All submitted documents shall be complete and coordinated between design disciplines.

All documents will address all comments from Schematic Design phase.

When 100% design development documents are available for review, the following
should be submitted to FM Global Plan Review Services for comment.

   Proposed building dimensions, finished floor elevations, surrounding contour elevations plan, number of stories, etc.

   Roof Construction Design & Assembly Requirements (including geographic area factors (rainfall, wind speed, etc.), proposed safety factors, construction importance factor, etc.)

   Fire Protection Design Requirements

   Project specifications document, if differ from the “Facilities Design Guidelines” document.

A basic project review letter will be completed by FM Global Plan Review or the FM Global project engineer to ensure the project successfully incorporates appropriate criteria according to applicable FM Global Standards.

The AEC team shall review the drawings required for multiple packages, if required, to ensure that the required drawing list is still accurate and that it is still valid. This is the time to modify the required list of drawings for the early release drawing sets.

If a contracting team is involved during the design phases of the project the BIMs shall be forwarded to them so that they may begin the process of creating submittal/shop drawings.

**Minimum Requirements for Design Development Submittal**

(Includes requirements for Schematic Design Submittal)

**Drawings**

**General**

- General Information Sheet(s) showing design criteria, net and gross square foot per floor, legend of symbols, abbreviations, drawing conventions, vicinity map & project location map.

**Hazardous Materials**

- Plan(s) showing location of hazardous materials found during survey.

**Civil**

- Demolition Site Plan containing all site demolition.
- Overall site plan(s) showing all new civil construction with demolished
items removed including spot elevations and dimensions.

- Separate plans showing site grading.
- Separate plans showing new vehicular paving with jointing and dimensions.
- Separate plans showing pedestrian paving with jointing and dimensions.
- Composite utility map including site mechanical, electrical and telecommunications.
- Separate plan and profile sheets for site water, sanitary and storm drainage.
- Drainage plan with calculations.
- SWPPP plan and details.
- Typical detail sheets.

Landscape

- Overall site plan(s) showing all new landscape construction with demolished items removed.
- Separate plans showing landscape features with spot elevations and dimensions.
- Separate plans showing new plantings.
- Separate plans showing new irrigation areas with type of heads and flow rates.
- Typical detail sheets.

Structural

- Foundation plan with pier sizes.
- Crawl Space grading plan showing drainage.
- Floor plan of all levels showing column grid, location of beams and shear walls.
- Column and beam schedules.
- Typical detail sheets.

Architectural

- Floor plan of all levels showing room names, room numbers, capacity information (occupancy), actual wall thicknesses, floor elevation, structural grid, equipment, casework, vertical transportation and dimensions.
- Floor plan of all levels showing fire protection elements and egress plan with travel distances
- Floor plan of all areas showing room names, room numbers, all furnishings and equipment, indication of finishes
- Reflected ceiling plans
- Roof plan showing major rooftop equipment
- Interior Finish Schedules
- Door Schedules
- Window/Glazing Schedules
All elevations showing materials, floor elevations, exposed mechanical and electrical equipment, finish grades and significant site features

Interior elevations of typical spaces like restrooms and casework and major spaces like lobbies and ballrooms.

Major building sections showing actual thickness of floors and walls, floor elevations, finish grades, room names, and significant mechanical and electrical equipment.

Typical wall sections and details

Enlarged stairways plan and section with railing details

Enlarged plan of restrooms with interior elevations

Enlarged plan and interior elevations of auditoriums and tiered lecture halls

Typical detail sheets.

Equipment

Floor plan of all laboratories showing laboratory casework and laboratory equipment.

Enlarged plan and elevations of typical laboratory spaces

Plumbing

Floor plan of all levels showing all plumbing fixtures/equipment and routing of horizontal and vertical runs

Details of major equipment and special conditions.

Mechanical

Site plan(s) at the same scale as other site plan(s) showing existing and new thermal and gas lines as well as limits of construction and construction staging area.

Floor plans showing single line duct layout for supply air, return air and exhaust air and location of mixing boxes, coils, dampers, etc

Enlarged mechanical room plans showing equipment, maintenance access

Preliminary mechanical equipment schedules

Typical details

Electrical

Site plan(s) at the same scale as other site plan(s) showing existing and new electrical distribution as well as limits of construction and construction staging area.

Floor plans showing typical light fixture layouts.

Floor plans showing typical power outlet layouts

Enlarged electrical room plans showing equipment and code required access

One line diagram of electrical system
Telecommunications

- Site plan(s) at the same scale as other site plan(s) showing existing and new telecommunications, data and cable television distribution as well as limits of construction and construction staging area.
- Floor plans showing means of cable distribution location of all devices and outlets
- Enlarged data/telecomm room plan showing equipment and access
- Enlarged plans showing location of audio-visual equipment
- One line diagram of data and telecomm systems

Reports

Basis of Design

The Basis of Design report from Schematic Design shall be updated to include the basic information, criteria, logic, major decisions, evaluations and considerations developed in the following applicable categories to prepare the Design Development submittal.

- Hazardous Materials Survey Narrative
- Civil and Landscape Design Narrative
- Structural Design Narrative
- Architectural Design Narrative
- Interior Design Narrative
- Mechanical Design Narrative
- Plumbing Design Narrative
- Electrical Design Narrative
- Data/Telecommunications Design Narrative
- Audio Visual Design Narrative
- Sustainable Design Narrative using LEED 2009 Checklist
- Listing and size of spaces comparing POR with Schematic Design and Design Development
- Code Analysis
- Energy Conservation
  - Provide a report on energy conservation provisions at Design Development that shall consist of compliance documentation that the building envelope meets the code. The report shall also include the manufacturer’s performance data for building envelope components. The report shall address all other code sections including HVAC, service water heating, power, lighting and other equipment.
To summarize the report shall cover the following ASHRAE 90.1 applicable areas and include all Compliance forms:

5.0 Envelope
6.0 HVAC
7.0 Service Water Heating
8.0 Power (Specification Item)
9.0 Lighting
10.0 Other Equipment (Specification Item)

Note: 8.0 and 10.0 will only be indicated in the project specifications.

OR
11.0 Energy Cost Budget Method

The SECO Compliance Certification form(s) shall be included in the front of the report. There may be one or more certification forms, depending on how many separate professionals take responsibility for the various disciplines. The Certification form must be preliminary at this point in the design.

- Life Cycle Cost Analysis
- Wind Tunnel Analysis
- Design Calculations
- Schedule of all recommended construction material testing. The schedules shall contain item tested, recommended test, frequency of test, estimated number of test, sampling method, testing method and acceptance criteria.
- Clash and collision detection report. This report shall consist of the report run after a preliminary run of the report which identifies issues that are addressed before running the final DD report for submittal. The A/E is responsible for generating this report in the absence of a contracting team. When a contracting team is part of the design phases they shall be responsible for running and vetting the report.

Specifications

- Specifications for significant architectural materials and engineering systems and equipment indicating quality of materials used in project

Cost Estimate

- Cost estimate in MasterFormat 2012 format.

Completion of Design Development

Completed Design Development documents are a result of a completed product and are not a function of time or duration of work.

Final Design Development documents that are “on average” 100% complete are not
Upon completion of Design Development the following are established such that the Construction Manager at Risk can provide a Guaranteed Maximum Price for the project.

- The project scope, form and spatial relationships are finalized.
- The design of all major building systems such as civil, landscape, site utilities, exterior envelope, interior finishes, structure, mechanical, plumbing, electrical and special systems such as telecommunications, data, audio-visual and security are completed.
- A construction schedule is established.
- The project as designed is achievable within the established Amount Available for the Construction Contract based on continuous input from the Construction Manager at Risk.
- Drawings and specifications for an early release package are ready for construction on CMAR and D-B projects.

After approval of the Design Development, the A/E shall furnish the following if required in their agreement:

- Presentation rendering(s) shall consist of an exterior view and/or interior view, drawn in perspective, at a scale of sufficient size (24" x 30" min.) to convey a true representation of the design of the project without distortions that would give misleading impressions. Landscape features together with existing structures should be indicated in a realistic manner. The perspective, professionally prepared, may be rendered in any color media, provided suitable reproductions can be made from the media selected and it shall be glazed with non glare glass and framed. The frame shall be clear maple in a rectangular profile with dimensions approximately ¾" by 1-1/4". The name of the project, location, and the name of the A/E shall appear along the lower edge of the perspective. Photographs of models are not acceptable.

- Detailed scale model of the project, in order to give a better understanding of the project as to scale, proportion, mass, or location, indicating fenestration, exterior material, color, trim, walks, drives, parking, and major landscape features. The model shall be mounted on a wood base and protected with a plastic cover. Scale shall be determined by the A/E and the FPC Project Manager; however, the overall dimension should not exceed 48" x 48".

- Presentation animation. The animation shall be fully rendered and be of at least one minute in duration. It shall show the exterior of the building and its site as well as the interior of significant spaces. The resolution shall be 1080P that is a resolution of 1920x1080 at 30 FPS. Light quality shall be ray trace with environmental maps. The textures shall be photorealistic.

- PowerPoint presentation of the project that includes campus plan, site plan, representative floor plan(s), exterior perspective(s) and presentation animation. The PowerPoint will be used by the Facilities Planning and Construction to present the project to the Board of Regents for approval. The slides shall have
light colored backgrounds. Black background with white line work is not allowed for PowerPoint presentation.

Guaranteed Maximum Price

In the CMAR Agreement the Construction Manager is required to submit a Guaranteed Maximum Price Proposal (GMP) based on the Design Development documents and review comments. The GMP is required to be submitted to the FPC Project Manager no later than three (3) weeks after the Design Development Review Meeting. The A/E team is expected to assist the Contractor in developing the GMP.

Formatting of GMP Documents

The contractor shall submit three (3) copies of the GMP documents each in a three ring binder. The three original signed GMP proposal (Exhibit “E” from the Agreement) shall not be bound in any binder. The GMP documents shall contain the following:

- Cover of GMP document titles “Guaranteed Maximum Price Proposal for (Project Name), System Member name, Project Number,
- Transmittal letter to Chief Financial Officer and Treasurer
- Table of Contents
- Summary of work including phasing plan, anticipated Notice to Proceed date and Substantial Completion Date.
- Copy of Exhibit “E” with Detailed Cost Breakdown
- Master Project Schedule showing phasing and all major milestones.
- Staffing Plan

Construction Documents

The approved Design Development documents shall be developed into Construction Documents sufficient to construct the project.

Construction Documents should be submitted to FM Global Plan Review at 50% completion. At this stage, the review confirms the project is in alignment with the Design Development drawings. If significant changes in design have occurred, the intent of the review is to again validate incorporation of key FM Global loss prevention criteria. A re-submittal at the Construction Document Phase would be required. If no major deficiencies are noted, and the only comment or addendum from Plan Review is request for additional information, re-submittal can be addressed in the Shop Drawings & Submittal Phase. This intent shall be communicated by letter to the Plan Review Department if letters are received requesting “additional information.”

Progress Meetings

The project time schedule and the agreements identify interim progress meetings for
review of Construction Documents by System Member and FPC staff generally at 25%, 50% and 75% stages of completion. These meetings do not constitute approval of documents to date, but are for the purpose of answering questions and resolving problems.

During the 25% Construction Documents meeting the Project A/E needs to present to the FPC Project Manager and others at least two interior color schemes for comments. Updates and refinements to the mechanical systems sequence of operation need to be presented for comment. Also, during the review the team must review cut-sheets of all major elements of the design and pieces of equipment with FPC personnel. Examples of these are curtain wall systems, fixed seating, laboratory equipment, audio visual equipment, air handling units, variable air volume boxes, plumbing fixtures and light fixtures. Verify list of items requiring cut-sheets with FPC Project Manager.

During the 50% Construction Documents meeting the Project A/E needs to present to the FPC Project Manager and others the revised interior color scheme for comments. Updates and refinements to the mechanical systems sequence of operation need to be presented for comment. Also, during the review the team must review revised cut-sheets of all major elements of the design and pieces of equipment with FPC personnel.

Reports

Basis of Design

The Basis of Design report from Design Development shall be updated to include the basic information, criteria, logic, major decisions, evaluations and considerations developed in the following applicable categories to prepare the Construction Documents submittal.

- Hazardous Materials Survey Narrative
- Civil and Landscape Design Narrative
- Structural Design Narrative
- Architectural Design Narrative
- Interior Design Narrative
- Mechanical Design Narrative
- Plumbing Design Narrative
- Electrical Design Narrative
- Data/Telecommunications Design Narrative
- Audio Visual Design Narrative
- Sustainable Design Narrative using LEED 2009 Checklist
- Listing and size of spaces comparing POR with Schematic Design and Design Development
- Code Analysis

- Energy Conservation
  Provide a report on energy conservation provisions at Design Development that shall consist of compliance documentation that the building envelope meets the code. The report shall also include the manufacturer’s performance data for building envelope components. The report shall address all other code sections including HVAC, service water heating, power, lighting and other equipment.

To summarize the report shall cover the following ASHRAE 90.1 applicable areas and include all Compliance forms:

5.0Envelope
6.0HVAC
7.0Service Water Heating
8.0Power (Specification Item)
9.0Lighting
10.0Other Equipment (Specification Item)

Note: 8.0 and 10.0 will only be indicated in the project specifications.

OR
11.0Energy Cost Budget Method

The SECO Compliance Certification form(s) shall be included in the front of the report. There maybe one or more certification forms, depending on how many separate professionals take responsibility for the various disciplines. The Certification form must be preliminary at this point in the design.

- Life Cycle Cost Analysis
- Wind Tunnel Analysis
- Design Calculations
- Schedule of all recommended construction material testing. The schedules shall contain item tested, recommended test, frequency of test, estimated number of test, sampling method, testing method and acceptance criteria.

- Clash and collision detection report. This report shall consist of the report run after a preliminary run of the report which identifies issues that are addressed before running the final DD report for submittal. The A/E is responsible for generating this report in the absence of a contracting team. When a contracting team is part of the design phases they shall be responsible for running and vetting the report.

**Drawings**

- Complete and coordinated drawings.

**Specifications**
Complete specifications with a minimum of three manufacturers for all items

**Cost Estimate**

Cost estimate in MasterFormat 2012 format.

**100% Construction Documents Review**

Drawings for all divisions of work shall be complete and thorough in all respects, well coordinated, clear, and neatly drawn and in accordance with the Standard of Care for the professions.

Completed Construction Documents are a result of a completed product ready to be used for construction (bidding in the case of CSP delivery) and are not a function of time or duration of work.

Construction Documents shall not be submitted for review until all documents are 100% complete and a complete quality control/coordination check has been made by the Project A/E of all documents.

If the Construction Documents are missing information from team members or drawing sheets are obviously incomplete do not submit for the 100% Detailed Design review.

If cursory review by FPC Project Manager indicates that the documents are not 100% complete, the submittal will be returned for completion.

A Construction Documents review meeting will be scheduled by the FPC Project Manager to include representatives from the A/E team, the Contractor team, the System Member team and the FPC team for a detailed discussion of comments.

All comments from the Construction Documents review meeting shall be incorporated into the final documents prior to issuance for construction (bidding in the case of CSP delivery). No lengthy addendum to correct the CSP bid documents is acceptable.

**Bidding and Contract Award Stage (CSP Only)**

The FPC Project Manager will establish the dates for advertising, pre-proposal conference, and proposal opening in consultation with the Project A/E for major projects that utilize the Competitive Sealed Proposal process to procure a Contractor.

The CSP process calls for a three (3) part proposal submittal. The proposal parts are identified as:

- Part 1 - Competitive Sealed Proposal (Price and Time)
Part 2 - Proposer's Qualifications
Part 3 - HUB Subcontracting Plan

The Project A/E is responsible for helping to secure good competitive proposals. The Project A/E shall oversee the distribution of plans and specifications to general contractors, sub-contractors, suppliers and plan rooms. The Project A/E shall also forward to the FPC Project Manager and all plan rooms on a weekly basis a list of all plan holders.

The Request for Proposals (Bid Advertisement) will be prepared and submitted to the media by the Facilities Planning & Construction Department. A copy of the advertisement along with Division 0 and Division 1 documents will be provided by the FPC Project Manager to the Project A/E to be included in the Specifications.

In addition to the bound plans and specifications all general contractors shall be provided two (2) loose copies of the Proposal Parts 1 through 3, two (2) loose copies of the Bid Bond form, and one (1) unimailer envelope.

If addenda are issued by the Project A/E, each Addendum sheet shall be dated with pages numbered consecutively.

The Project A/E is responsible for the distribution of all addenda to all plan holders at no additional cost.

The Project A/E and required consultants will attend the Pre-proposal Conference prepared to receive contractor's questions and conduct a site tour if necessary.

The Code “E” Estimate will be prepared and submitted 10 days before receipt of proposals and should reflect any factors affecting the cost that the Project A/E may be able to determine during the bidding period.

The FPC Project Manager will prepare a "Bid Tabulation Form", with assistance from the Project A/E, which lists all expected general contractors and provide sufficient quantities to satisfy the needs at the Bid opening.

The Project A/E is required to attend and assist with the proposal opening procedure to be conducted by the Area Manager. At the conclusion of the proposal opening the Project A/E will be provided one (1) copy of all Part 2 General Contractor Qualifications submittals. The Project A/E will also receive instructions from the Area Manager as to their responsibilities during the contractor evaluation and negotiation period.

The Project A/E will assist in analyzing bid proposals, and provide reports as required concerning the experience, qualifications and references of the bidders, including the named subcontractors and suppliers.

The Project A/E is required to attend the contractor evaluation meeting. The Project A/E
shall bring all Part 2 submittals to this meeting. FPC will retain these copies and return them to the contractor.

The Project A/E will assist the Owner during negotiations with the selected Contractor by evaluating the value engineering offerings from the selected Contractor. The A/E will be required to provide any and all documentation required to adequately describe the nature and extent of all accepted value engineering items.

The Project A/E shall assemble all value engineering items from all general contractors and subcontractors into a computer spreadsheet format. This spreadsheet shall to be emailed to the FPC Project Manager prior to the Contractor Evaluation meeting. On the spreadsheet the Project A/E team needs to indicate their opinion (yes, no or maybe) for each value engineering item. Upon receipt of the spreadsheet System Member and FPC staff will do likewise. At the end of the Contractor evaluation meeting all parties will review the list with comments do determine a final list that will be presented to the first ranked contractor at the first negotiation meeting.

The items that are listed as yes or maybe will be presented to the selected contractor for pricing. At the conclusion of the negotiations with the selected contractor the contractor will prepare a Post Proposal Amendment which will include all value engineering items that are accepted by the Owner. This Post Proposal Amendment will be signed by both the Contractor and the Project A/E and will be included in the construction contract award documentation.

**Contract Award (CSP Only)**

Immediately following action by the awarding authority, the successful Bidder will be notified of the award by facsimile message from and by the Owner.

The Project A/E will not incorporate any addenda into a “construction set” to be issued to the Contractor. The “Bid Sets” are to be used by all parties to construct the building and it is the responsibility of each party to post all addenda and post proposal amendment information to these “Bid Sets”.

The Owner will assemble the Contract Books and secure signatures.

When the contract books are signed and all bonds and insurance is in place the "Notice to Proceed" will be issued to the Contractor by the Chief Financial Officer and Treasurer.

**A/E Bid Analysis (Competitive Bids Only)**

The A/E will submit to the Owner a bid analysis within 48 hours after the bid opening. This analysis will provide information to the Owner for his consideration in taking action on the bids. The analysis shall be a concise evaluation of the low bidder and his
bid amount(s).

Investigate the low bidder's capability, past performance, and experience, particularly in construction similar to subject project. Include this information in the analysis. (The Owner will investigate the financial status of the low bidder.)

Evaluate base Bid and Alternate Bids with respect to the Code "E" Cost Estimate and include in the analysis along with recommendation on acceptance of alternates.

If in the opinion of the Project A/E, the lower bidder is not considered qualified to perform the work, confer with the Area Manager for determination of further action.

As needed, contact the lower bidder and obtain information necessary to prepare cost comparisons of quantity take-offs and price extensions with major elements of the detailed design estimates. Include this comparison and explanations of cost differences in the analysis.

If no bids are received or only one bid is received at the time of opening the Project A/E needs to determine the reasons for lack of bidders.

**Construction**

**Pre-construction Conference**

After the construction contract has been awarded the FPC Project Manager will establish a date for the Pre-Construction Conference. The Project A/E is expected to attend. The FPC Project Manager will review Owner procedures to accomplish the terms of the construction contract.

**BIM Transition**

The A/E will transition the maintenance of the project models to the contracting team once all addenda are issued. From this point forward the contracting team shall be responsible for keeping the model up to date and transitioning the design intent model to a construction/as-built model. The A/E shall still be responsible for issuing model updates for responses to RFIs, and any changes caused due to ASIs, CCD, change requests, or any other change driven by the owner. Installation changes are the responsibility of the contracting team.

**Monthly Progress Meetings**

On the same day each month a monthly progress meeting will be held. The Project A/E is expected to attend and be able to answers questions that arise.

The Project A/E is required to attend all monthly construction progress meetings. The
A/E team consultants may be required to attend specific monthly meetings based on the project’s requirements.

**Color Boards**

The Project A/E is required to develop color boards for all exterior and interior colors based on the contractor’s manufacturer and/or supplier. The color boards shall be presented to the system member representative for approval. After approval the Project A/E will develop a second set of interior colors assembled into a 3-ring binder. The Project A/E shall also generate a listing of all finish materials for the FPC Project Manager and the General Contractor. The AE is responsible for updating all binders throughout the construction phase of the project.

The Project A/E shall also provide an updated listing of all finish materials along with the Record Drawings.

**Subcontractor Best Value Recommendations**

The contractor is required to submit subcontractor best value recommendations to the Owner for approval for all subcontracts on construction manager at risk and design-build projects. The subcontractor best value recommendations shall be bound in a three ring binder and contain the following:

- A transmittal letter summarizing the contents of the recommendation package and recommended subcontractors
- Subcontractor evaluation and methodology
- Subcontractor Proposals
- Technical Proposals
- HUB Plans

**Shop Drawings and Submittals**

All major subs shall be required to work in BIM authoring software. Typically this includes MEP and fire protection. Other subs that shall be required to produce and update BIMs are structural subs, elevator installation, and subs working on the building skin.

The contracting team is required to update the BIM model to reflect actual products being installed. They are required to update the information required of the AE as well as the addition of serial numbers for equipment. When required by the facility management team RFID and/or Bar Codes shall be affixed to equipment.

The Project A/E team is responsible for the timely review and processing of contractor shop drawings and submittals as indicated in the Uniform General and Supplemental Conditions included in the Design Criteria section of this manual.
Submittals for roof systems and fire protection systems shall be submitted to FM Global for review. Project A/E shall coordinate with FPC Project Manager for this submittal. Project A/E shall include filled out FM Global’s Application for Acceptance of Roofing System with roof submittal.

**Roof Construction & Assembly**

Full submittals for roof construction and assembly should include the following:

FM Approved RoofNav Assembly Number, which can be found at [www.roofnav.com](http://www.roofnav.com). All components within the assembly should be FM Approved, as well as Approved for the given assembly. Contact the Plan Review Department for additional assistance.

Plans and calculations for proposed primary & secondary roof drainage are still needed for review.

FM Global Form X2688: Application for Acceptance of Roofing System.

**Fire Protection System Design**

For Existing Underground Fire Mains & Water Supplies:

Occupancy Description

Recent water tests and available supply calculations at effective point

For New Underground Fire Mains & Water Supplies:

Occupancy Description

Recent water tests and available supply calculations at effective point

Full list of all materials and components; FM Approved materials should be utilized. (To check for FM Approval, visit: [www.fmapprovals.com](http://www.fmapprovals.com)) This includes fire pump equipment and controls, above ground tanks, etc.

For Fire Sprinkler Protection

Properly labeled engineering drawings, in accordance with FM Data Sheet 2-0

Hydraulic calculations for all zones

Full list of all materials and components; trade name and sprinkler identification no. and/or FM Approval no.

Sprinkler Design, in accordance with FM Data Sheet 3-26, and the sprinkler design specified by during the Schematic Design Phase Review.
Special Protection Systems (gaseous, CO2, dry chemical, etc.) submissions in full in accordance with FM Data Sheet 2-0, but should include manufacturer, design calculations utilizing manufacturer’s approved software

**Coordination Drawings**

As required in Division 1, Section 01 31 00 the General Contractor is required to produce coordination drawings that will be submitted to the Project A/E for approval. The Project A/E shall review these like all other shop drawings and submittals. The contracting team shall maintain copies of all coordination drawings on site for use on site. Each major sub is required to produce coordination drawings. The lines for the various disciplines shall be unique. There shall be a master coordination drawing at printed in color at 1/4” scale which is a combination of all of the coordination drawings. This drawing shall be used for field coordination purposes only. It is to be issued to the AE for information purposes only. The coordination drawings shall be kept up to date and reflect any changes made in the field. These changes are to be made in the as-built model and reflected in the record drawings.

**Substitution Request**

The Project A/E team is responsible for the timely review and approval or rejection of contractor substitution request. Concurrence from FPC Project Manager is required prior to the approval of any substitution request.

**Inspections**

The A/E shall be responsible for transcribing any and all punch lists as prepared by the A/E, its consultants and Owner. The Owner will provide a blank form and sample for A/E to use. The Owner will either convert its punch lists to a WAV, WMS or DSS file and email to the A/E. The Owner’s punch list is recorded in Olympus’ DSS format compatible with Olympus transcription equipment. The A/E may elect to purchase the Olympus AS 5000 Transcription Kit that comes complete with software.

**Record Drawings**

The Project contracting team is responsible for recording all items from the contractor’s record prints, models, and providing the FPC Project Manager the appropriate Record Drawings as per this manual. The record drawings/model shall be a representation of the as-built condition of the building. They shall reflect changes made due to constructability as well as field coordination issues. The drawings/model shall be accurate reflections of the location of valves, dampers, and any other equipment concealed in the ceiling plenum that may need periodic maintenance.

**COBie Data**

The contractor is required to extract COBie data from the construction BIM for import
into the FM software. The most efficient way to get the COBie data is to ensure that it is input into the BIM as parametric data associated with the various families/objects. The COBie data should be checked for consistency and to ensure that all of the required data fields have been completed. If information is missing it should be updated or added to the model then extracted again. Editing of the COBie data in chart form should be avoided to ensure that the required information is embedded in the model and not just the chart. There are software packages available which can be used to help expedite this process. Note: Costs to use these packages should be included in the project and are not permissible as added cost to the project.

**FM Global Final Acceptance**

Final acceptance of all projects requires resolution of all outstanding recommendations on Plan Review letters, and final field acceptance or documentation where required, which can be summarized as follows:

**Roof Construction & Assembly**

Uplift Testing for built-up roof systems is required for new roofs or roof recovers at campuses within regions that are both (a) prone to hurricanes/tropical storms, and (b) are located within design wind-speed regions of at least 100mph (Corpus Christi, Galveston, Houston & Kingsville.) Please provide advanced notification (minimum 3 weeks) of Uplift Testing to the FM Global Account Engineer.

Mechanically attached, single-ply membrane roofs cannot be subjected to Uplift Testing, and will only be subject to field review at stages during and concluding installation.

If adequate notice is provided, an FM Global field engineer or the assigned FM Global project engineer will be coordinated to witness the uplift testing to confirm workmanship and final assembly.

FM Acceptance Form X2688: Application for Acceptance of Roofing System must be submitted.

**Fire Protection System Design**

FM Acceptance Form X85B Contractor's Material & Test Certificate for Underground Piping must be submitted (This includes signature of witness to 2-hr hydrostatic testing, conducted in accordance with FM DS3-10 and DS2-0)

FM Acceptance Form X85A Contractor's Material & Test Certificate for Aboveground Piping must be submitted (This includes signature of witness to 2-hr hydrostatic testing, conducted in accordance with FM DS2-0 and other applicable standards)

FM Global engineer conducts Field Acceptance visit as recommended.
FM Global Plan Review Submittal Procedures

A full submittal (hardcopy only) should be sent to the Dallas Plan Review Department:

FM Global – Dallas Operations
Attn: Carl Funk, Plan Review
5700 Granite Parkway, Suite 700
Plano, TX 75023

Each submittal shall include a coversheet with the following information:

Client Name: Texas A&M University System
Account Number: 01-68099
FM Global Index Number: (See Tables Below)
FM Account Engineer: Allison S. Olsen
Project Name: Campus – FP&C Project ID Number & Project Name
Stage of Project & Submittal Type
   i.e. - Schematic Design, Design Development Phase, Construction
   Document Phase, Construction /Shop Drawings & Submittals Phase, or
   Final Acceptance
   e.g.-“Roof Submittal: Recover Assembly & Drainage Calculations, 1st
   submittal, 75% Construction Drawings”
Submitter’s Name, Company Name, Contact Information as well as TAMU FP&C
Project Contact (in case Plan Review has questions regarding the submittal)
Brief description of the scope of work
Approximate date to expect next submittal or provide a current copy of the
project timeline/Gantt chart
## CENTRAL

<table>
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<th>FM Global Index #</th>
<th>Location Title</th>
<th>Street Address</th>
<th>City</th>
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<td>605 Military Mall</td>
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<tr>
<td>00089454</td>
<td>John B. Connally Building</td>
<td>301 Tarrow Street</td>
<td>College Station</td>
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<tr>
<td>00154686</td>
<td>A&amp;M System Building</td>
<td>200 Technology Way</td>
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<td>3380 University Drive East</td>
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<td>3100 State Highway 47–Building 7091</td>
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<td>PVAMU School of Nursing</td>
<td>6436 Fannin Street</td>
<td>Houston</td>
</tr>
<tr>
<td>07403774</td>
<td>Health Science Center IBT Building</td>
<td>2121 West Holcombe Blvd</td>
<td>Houston</td>
</tr>
<tr>
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<td>Texas A&amp;M Health Science Center-Round Rock</td>
<td>3950 North A W Grimes Blvd</td>
<td>Round Rock</td>
</tr>
<tr>
<td>07454592</td>
<td>HSC Temple - Community Education Center</td>
<td>2401 South 31st Street</td>
<td>Temple</td>
</tr>
<tr>
<td>00136385</td>
<td>HSC Temple - Medical Research Building</td>
<td>702 Southwest H K Dodgen Loop</td>
<td>Temple</td>
</tr>
</tbody>
</table>
Plans will be reviewed within 2 weeks of the date they are received; Allow a minimum of 3-4 weeks before your “critical date” to allow for P/O changes, etc. Incomplete submittals will be not be given an “Acceptable” rating. After review, FM Global will return comments to submitter and a copy to the System Office of Risk Management and Facilities Planning & Construction Department, the FPC Area Manager, or the local campus project manager for locally managed projects.

Upon review of specifications, drawings, submittal packages, etc., FM Global’s plan review department will issue a letter indicating either “Acceptable” or “Unacceptable.”
This indicates whether or not the submittal has successfully met FM Global design criteria.

“Acceptable”: This indicates there were no major issues needing modification. There will likely be minor issues noted in the review letter needing to be addressed, but this specific stage of review does not need to be re-submitted. No specific response to the minor items noted in this letter is needed (unless there are not plans to address these items).

“Unacceptable”: This indicates that there were issues in the submittal such that it did not meet FM Global design standards. Therefore, these items need to be revised and a re-submittal of this stage of the review is needed within 30-days of the review. Depending on the type of recommendations in the letter, it may be possible to respond with an acknowledgement that these items will be addressed rather than a full re-submittal. For example:

If the review recommendation was in the design phase that the sprinkler density should be increased from 0.2-gpm/sq ft to 0.3-gpm/sq ft, this could be acknowledged through an e-mail to those copied on the distribution of the FM review letter.

If the review recommendation from the roofing submittal was that it was not FM Approved and did not have an FM RoofNav assembly number, a re-submittal would be needed.

Specific Campus Requirements

Texas A&M Health Science Center

Building Information Modeling (BIM) and Facilities Management (FM) Data Requirements

Executive Summary

Section 1 – Strategy and Objectives
Knowing the strategy and objectives of Texas A&M Health Science Center (TAM-HSC) in Building Information Management for Facilities Management (BIM for FM) is important for all project delivery teams (AEC + CxA) in order to satisfy the expectations and project requirements. The strategy and objectives section states that the BIM for FM process and documentation was undertaken in order to provide direction and to equip project teams for facilities management data specification, collection, validation, and ultimately handover to TAM-HSC. Handover deliverables shall be in a digital format and support operational objectives and efficiencies, such as import to the asset management (CMMS - Computerized Maintenance Management System) system AiM by AssetWorks.
Section 2 - BIM Execution Plan (BEP)
Developing and communicating a clear plan for carrying out BIM for FM is necessary for each project team. The BIM Execution Plan (also referred to as a BEP) section provides an outline and framework for planning how BIM for FM is to be accomplished at the project level. The overall intent is to allow and require project delivery team members to communicate to TAM-HSC how they intend to meet the BIM for FM requirements. Each member of the AEC team shall submit a plan per the stated requirements in this section. The Facilities Data Integrator (FDI) receives each plan and reviews it according to the contracted section requirements for that team member. This plan outlines items such as: company roles, contact information, AEC team collaboration procedures, information exchange schedules, quality control procedures, and others. Submitted execution plans enable the Facilities Data Integrator (FDI), an agent of the owner (TAM-HSC), the ability to better guide and manage teams to accomplish BIM for FM deliverables. The BEP allows teams to demonstrate how they will comply with the prescriptive requirements as well as the performance based requirements. This leaves room for project delivery teams to impose their own means and methods where prescriptive requirements do not exist.

Section 2 – Exhibit A – Sample Project Schedule

To keep from overwhelming the AEC team and to promote efficiency, a schedule is to be implemented and followed. This schedule shall be reviewed and approved by the Owner as part of the BIM Execution Plan approval process. Tailored to each individual project, the schedule lays out a plan for when data in each category should be collected, and the quantity of that data.

Section 2 – Exhibit B – Close-Out Procedures

This section covers all the processes that will take place at the end of the project. These processes include End User and Owner Review & Acceptance, and the final handover of deliverables. Who is responsible for reviewing the submittal of COBie data is covered here, as well as the time period allotted to do so. If corrective action is needed, 30 calendar days are given to schedule a meeting with the FDI and Owner. Expectations placed on the Owner and the End User, in regards to Close-Out, are located here.

Section 3 - FM Data Criteria

The FM Data Criteria is the largest section of the BIM for FM Requirements documents. It is a detailed specification and guide to understanding how project information shall be organized and delivered to Texas A&M Health Science Center. This is the most prescriptive part of the BIM for FM process due to the specific and structured data requirements for TAM-HSC’s configuration of AiM. This section outlines what data is to be collected (i.e., what do we need), in what format (i.e., how do we need it delivered), division of responsibility (i.e., who is to collect specific information), and deliverable schedules (i.e., when are the milestone deliverables over the project’s duration).
level of detail is required in order to properly communicate and contract these requirements with the project delivery team members in each standalone contract with the owner (i.e., AE, CM, CxA, others). In the absence of this level of detail, confusion will be present and the process for BIM for FM will break down. This section introduces a role called the Facilities Data Integrator (FDI) to the project delivery team who is chosen by the owner to manage and ensure correct execution of BIM for FM data requirements and process across the entire project delivery process. This section references attachments and specific Texas A&M Health Science Center roles for providing the latest version of the facilities-specific data to be incorporated into projects. These requirements are the standard across all Texas A&M Health Science Center campuses.

Section 3 – Exhibit A – RAM with Mapping

This section covers three topics. The first, Data Collection and Schedule, lays out who is responsible for collecting what data. The second discusses AiM Data Mapping for each tab in the COBie File. The third determines who is responsible for assuring data content, accuracy, and format according to the specification and prior to import to AiM via an approved QA/QC process in the approved BIM Execution Plan.

Section 3 – Exhibit B – Facilities Data Integrator

This section covers the Facilities Data Integrator and lists responsibilities over the different phases of the project. These phases include the Planning/Programming phase and the Design/Construction/Commissioning phase. The specific requirements to fill the FDI role are also listed in this section.

Section 3 – Exhibit C – Asset Type Matrix

The Asset Type Matrix is a vital part of the BIM for FM process. This document contains a list of all assets that are expected to be collected. By referencing this document, the AEC team can easily see what assets the Owner wants included in the COBie file, and equally important, which ones they do not want included. Details such as Master Format, UniFormat and Omni-Class Numbers for each type are found here. Additional data, such as specific attributes required per asset type are also found here. There are two Sections to this document. The first section is a detailed list of the Asset Types and the second is a condensed list.

Section 3 – Exhibit D – FM Model Criteria

FM Models can be used for BIM for FM. The intent of this section is to include the minimum criteria for 3D models as they relate to the BIM for FM Deliverables alone. The construction contractor is to provide two versions of design models and two versions of Coordinated models. Details such as what color a particular system should be, and what format the files need to be in before handover are covered here.
Section 1: Strategy and Objectives

Explanation of the BIM Strategy and Objectives

Texas A&M Health Science Center (TAM-HSC) desires to use technology to handover construction projects in a digital format that supports operational objectives and efficiency. The strategy and objectives of TAM-HSC in Building Information Modeling for Facilities Management (BIM for FM) is important for all project delivery teams (AEC + CxA) in order to satisfy expectations and project requirements. The strategy and objectives section states that the BIM for FM process and documentation was undertaken by TAM-HSC in order to provide direction and to equip project teams for facilities management data specification, collection, validation, and ultimately handover to TAM-HSC. Handover deliverables shall be in a digital format and support operational objectives and efficiencies, such as import to the asset management (CMMS - Computerized Maintenance Management System) system using AiM by AssetWorks. Through the establishment of BIM for FM requirements, TAM-HSC will obtain consistent and useful handover deliverables (digitally formatted) that support operations and maintenance for many years to come. TAM-HSC’s intent is to facilitate and produce a repeatable process that can be employed on capital projects of various sizes.

The intent of this document is not to add unreasonable scope upon individual project team members, but rather to provide a method and format for capturing useful project information that is already being managed throughout the planning, design, construction, and commissioning phases. In some cases, project team members will realize efficiencies by following these guidelines and having a consistent project repository of facility data and associated documents. For other team members that already use a thorough system for tracking project spaces, equipment, and documents, this guideline will have little impact upon their current project workflows other than to specify the owner’s requirements. By TAM-HSC investing in the development of this process, they will be able to contract for these requirements in the course of the normal project delivery process, reduce change orders, reduce rework, and allow project team members the opportunity to align their project delivery processes and data management processes in advance of the performance of work. This alignment is intended to streamline the project delivery process for digital data and documents for handover and integration by the Facilities Data Integrator (FDI) into the owner’s operations and maintenance systems, namely AiM by AssetWorks.

TAM-HSC requires BIM to be used in a way that supports evolving and advancing operational and maintenance workflows. Some specific BIM uses that the project team will be required to support include but are not limited to: 1) record set / as-built 3D Models, 2) Facilities Management Navisworks models designed for identifying building systems, and 3) FM data set production (for use in COBie data set compilation) with associated documents to be imported to AiM by the Facilities Data Integrator (FDI). The process established and confirmed by TAM-HSC does not require each project delivery team member to be a 3D modeling subject matter expert, an FM data subject
matter expert, or a COBie subject matter expert. Instead, the project team members are required to provide elements of the facilities management data set requirements over the life of the project in an open-standard format or in a manner that enables the Facilities Data Integrator (FDI) to extract the same information using industry standard tools and software from the provided 3D models. These project details will be documented and confirmed by the approval of the BIM Execution Plan (BEP) elements for each team member. BEP revisions may be required as team members are added and as the overall plan evolves for the project team members. One of the FM Data Integrator’s roles is to manage the overall FM Data (BIM) process and oversee the compilation (i.e., integration) of the FM Data while ensuring that configuration control is maintained for revisions and changes over the lifecycle of the project. Thus, team members are expected to provide the same type of project information they normally produce for use at specific points in the project lifecycle. These are outlined along with the specific details of the role of FM Data Integrator in other sections of the specifications. The BIM Execution Plan (BEP) will outline and document the project specific processes to be employed and will provide a mechanism for owner review and approval of the FM Data process via submittals for review and approval by the FDI. In this manner, additional services are not expected from the project delivery team members because TAM-HSC is not asking for new deliverables but rather, the same information in a modified format in advance of contracting and work production to eliminate the occurrence of rework.

Description of Existing Infrastructure and other Operational Interfaces

TAM-HSC currently uses AiM by AssetWorks as its computerized maintenance management system (CMMS). AiM supports the import of COBie (Construction Operations Building Information Exchange) files, which is an industry recognized open standard data format. COBie is one “tool” that is used in this process to organize and format the FM Data for use. The data structure (i.e., Asset Groups) from AiM will help guide the assembly of COBie data at TAM-HSC. These data structure rules have guided and informed the development of these requirements, and when followed correctly, will ensure project teams have built the COBie data-set in a manner that is consistent with TAM-HSC CMMS requirements and data structures.

TAM-HSC currently uses 3D models as a tool in facilities management. By requiring project teams to share building models, allowance is made for immediate and future needs. Therefore, all 3D Facilities Models (i.e., models from the AE (design intent) and the CM (as-built)) shall be provided in an acceptable format (see the FM data specifications) and not in any other proprietary or subscription based software. Additional requirements can be found in the FM data specifications.

As the construction industry and technology advances, TAM-HSC will make incremental changes to the BIM for FM requirements over time. The current specifications represent the first generation of FM Data specifications; changes are anticipated that will improve processes and will integrate future technologies and workflow over time. However, these must be evaluated by TAM-HSC for adoption from the industry and
integrated into the project delivery strategy and handover requirements in light of how TAM-HSC does FM work and how they want to receive and process project information (data), documents, and models.

Explanation of TAM-HSC Expectations

The FM data specifications developed for and applied to this project are an evolving guideline for capturing BIM-FM data at TAM-HSC. However, a specific set of requirements does apply to this contract. With each new building, this specification may require the attention of a Facilities Data Integrator (FDI) to ensure current requirements are appropriate and/or are updated for additional scope that was unforeseen at the writing of the current publication. This updating process will continue to “build-out” and enhance the overall FM Data specifications in a way that creates a more robust specification based upon project scopes and building/project types at TAM-HSC. The first generation FM Data specifications have been formulated to capture as much institutional information as possible based upon past FM Data projects conducted. It should be noted that each owner has a varying array of interests and requirements that are driven by their perception of the value to the FM process. Thus, these requirements are likely to be modified over time as more operating experience is gained in the use of FM Data and associated documents.

The FM Data Integrator shall also assess each project teams’ ability to perform the scope of the BIM and FM data requirements and provide specific recommendations for implementing requirements on a project by project basis. The role and responsibility of FM Data Integrator is outlined in other sections of this guide. However, the general responsibility is to manage the BIM process and the FM Data on projects and to ensure the correct execution of these BIM for FM Data guidelines. The role of the FM Data Integrator can be performed by different parties within the project delivery team during construction or within TAM-HSC (i.e., internal direct staff or a third party consultant) throughout a project’s life cycle.

TAM-HSC expects that all large scale projects will use the current BIM for FM requirements and produce an FM data-set for import into the CMMS. However, the Director of Facilities Management will determine expectations in regard to these requirements on projects under five million ($5M) dollars. Project team members will each be expected to contribute to the project’s FM Data requirements where appropriate, contracted, and as explained through this specification.

Specific information regarding responsibility and accountability are detailed in other sections of this specification. However, some of the general expectations include but are not limited to the following: 1) the party responsible for space planning will be expected to provide a schedule of spaces with use categories and associated space attributes, 2) the A/E in the design phase will be expected to provide square footage information, 3) the construction contractor will be responsible for providing equipment location, manufacturer, model, asset attribute information, and associated documents as the submittal process is completed. The construction contractor will also be expected during
construction to assign documents (drawings, submittals, O&M’s, and others) to equipment and serial numbers via the FM Data format as well.

Section 2 – BIM Execution Plan (BEP)

The objective of this section is to provide a project specific plan on how the BIM for FM requirements and deliverables will be accomplished. Each member of the AEC team shall submit a plan, to the Facilities Data Integrator (FDI), conforming to the requirements set forth in this section and other parts of the BIM specifications. The intent is for the BIM Execution Plan (BEP) to clearly identify how the project team members will comply with the BIM for FM Data requirements as well as how they will cooperate and coordinate with the other team members.

Following the review of individual BIM Execution Plans, the Facilities Data Integrator (FDI) shall coordinate a meeting to provide a Team BIM Execution Plan (BEP). The Team Execution Plan shall provide considerable detail on deliverable schedules, review points and process, grading, and handover requirements. For more information on aspects of the team execution plan, see other sections and exhibits to the BIM for FM requirements.

The submittal process is employed to allow team members to respond to the requirements on two main fronts. First, the BIM and FM requirements have certain aspects that are prescriptive. That is, TAM-HSC requires certain elements of the requirements in a particular content, format, and timeframe from specific team members. See the requirements for further details. Secondly, the BIM and FM requirements have certain aspects that are performance based. That is, the owner desires and requires certain outcomes and results to be achieved. However, the owner does not want to impose means and methods of deliverable or result production that are unreasonable. Thus, the team member, for these elements of the BEP, is allowed to propose and describe their plan, approach, and means/methods for achieving the requirements and desired outcome. This is intended to provide reasonable flexibility for the team members in order to allow for workflow and deliverable production efficiency when and where an owner’s need for a prescriptive requirement does not exist.

The following outline is a “framework” only and the team members are encouraged to add additional sections and subsections to the plan as needed. The framework below is intended to communicate the minimum content required (not the maximum). We recognize that many project delivery team members have prepared and executed multiple BEP’s in the past. The intent in this specification is to launch the BEP development process and not to limit the BEP contents to this document. Team members are encouraged to add information to the extent needed to clearly communicate their implementation intent and plans. Several different BEP formats have been developed in the industry and this specification and framework is not intended to be a limiting factor in the team members’ efforts to communicate and seek approval from the owner for the BEP. As the BEP is incrementally developed by the team members, additional details and clarifications are expected to be required to clarify
how team members will interact and deliver on the entire set of requirements. It is expected that the BEP will have multiple revisions as the team iterates to a completed project and meets the overall requirements. The intent is also to eliminate rework on elements of the BEP that are approved. Team members are expected to consider downstream team members in the process and take every reasonable measure to minimize and eliminate rework. The FM Data Integrator will assist in this determination and will be the primary party representing the owner in the BEP approval process.

Section A: Project Information

Project Data

1. Project Owner:
2. Project Name:
3. Project Location & Address:
4. Contract Type/Delivery Method:
5. Concise Project Description: [number of facilities, general size, etc.]
6. Additional Project Information: [unique BIM project characteristics and requirements]
7. Project / Contract Numbers: [Contract Number, Task Order, Project Number, etc.]
8. Project Schedule / Phases / Milestones: [include BIM milestones, pre-design activities, major design reviews, stakeholder reviews, and other major events which occur during project lifecycle]

Project Schedule

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<th>Estimated Completion Date</th>
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Section B: Project Goals

Acknowledgment of BIM and FM Data Requirements

1. Identify Major BIM and FM Data Goals / Objectives: [state major BIM & FM data goals, actions to implement, evidence the goal has been achieved, and participants involved]

Section C: BIM Uses

1. Identify Major BIM uses on the project: [state major BIM use cases, their author, other users, and file types (if applicable)]
2. Identify Project Assets: [see ‘TAM-HSC Asset Type Matrix’ and indicate project assets]
3. Identify Elements to be Modeled and the responsible party to model such elements
4. Identify other areas of particular interest in BIM that require clarity: [origin point, scale, model maintenance, other CAD/BIM Guidelines applicable, etc.]

Section D: BIM Use Staffing

Organizational Roles / Staffing

1. BIM for FM Roles and Responsibility:
2. BIM Use Staffing: [for each BIM & FM use selected, identify the team within the organization(s) who will staff and perform that use and estimate the personal time required. This helps the owner understand the level of effort (i.e., staffing plan) expected by the team members in delivery of the requirements.]

<table>
<thead>
<tr>
<th>BIM for FM Use</th>
<th>Organization</th>
<th>Number of Total Staff for Use</th>
<th>Estimated Worker Hours</th>
<th>Location(s)</th>
<th>Lead Contact</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Section E: Collaboration Procedures

1. Collaboration Strategy: [describe how the project team will collaborate. Include items such as communication methods, document management and transfer, file naming structure, and record storage, etc.]

2. Meeting Procedures: [the following are examples that should be considered]

<table>
<thead>
<tr>
<th>Meeting Type</th>
<th>Project Stage</th>
<th>Frequency</th>
<th>Participants</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIM for FM Requirements Kick-Off</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIM for FM Execution Plan Demonstration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design COBie Review</td>
<td></td>
<td></td>
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<tr>
<td>Construction COBie Review</td>
<td></td>
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<tr>
<td>Any other BIM meetings that occur with</td>
<td></td>
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</tr>
</tbody>
</table>
3. **BIM for FM Delivery Schedule of Information Exchanges for Submission & Approval:** [document the exchange of COBie and Model data that occurs during the project:]

<table>
<thead>
<tr>
<th>Information Exchange</th>
<th>File Sender</th>
<th>File Receiver</th>
<th>One-Time or Frequency</th>
<th>Due Date or Start Date</th>
<th>Native File Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design COBie</td>
<td>Architect</td>
<td>Contractor</td>
<td>One-Time</td>
<td>NTP</td>
<td>.xls</td>
</tr>
</tbody>
</table>

**Section F: Process for Data Verification – QA/QC**

1. **Overall Strategy for Quality Control:** [describe the strategy to control the quality of the data and model delivered]

2. **Quality Control Checks:** [the following check should be performed to assure quality]

<table>
<thead>
<tr>
<th>Checks</th>
<th>Definition</th>
<th>Responsible Party / Parties</th>
<th>Software Program(s)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Check</td>
<td>Ensure that the model and data have not excluded field items and requirements have been followed</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>COBie Compliancy Check</td>
<td>Ensure that the COBie standard has been followed in the building</td>
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</tbody>
</table>
3. Accuracy and Tolerances:
   a. Note: At any time during the project where the data errors grow to a point above 10% of the entire data set; the owner reserves the right to take appropriate corrective action such as having another party finish the BIM for FM deliverable at the expense of the responsible party in error. The FDI’s role is to take preliminary steps to preclude this action. However, if timely completion of the FM data process is delayed by an unreasonable amount of time, the owner may direct such corrective actions be taken.

Section G: Technological Infrastructure Needs

1. Software [List software that COBie data and Model will be created and maintained in]
2. Modeling Content (conforming to TAM-HSC Asset Requirements Matrix)

Project Deliverables [list the BIM for FM deliverables for the project and the format in which the information will be delivered]

<table>
<thead>
<tr>
<th>BIM for FM Submittal Item</th>
<th>Stage</th>
<th>Approximate Due Date</th>
<th>Format</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record Model</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FM Model</td>
<td></td>
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</tbody>
</table>
Section H: Process for Data Collection

1. Describe methods for collecting data during the project and how the team member intends to coordinate and collaborate with the Facilities Data Integrator (FDI).

Section J: Update of the BEP

1. Provide Plan for revising BIM Execution Plan at each stage.

Attachments to E.2 – Section 2 – BIM Execution Plan (BEP)

These are not attachments to the BEP but are critical parts of the requirements that must be considered in the development of and updates to the BEP.

- Exhibit 2.A - Sample Project Schedule (XLS File)
- Exhibit 2.B – Close-Out Procedures

End User Review & Acceptance

Test imports of the COBie data and documents may be performed leading up to final acceptance and review. However, once the COBie file has been successfully test imported into AiM, the Facilities Data Integrator (FDI) shall notify the Owner. The Owner then shall notify each end user to review assets identified as belonging to their respective department (organization). Areas of particular interest in review shall include those items that are shared between multiple end users/departments; ex: large Utility Water Valves should be reviewed by both Facilities Plumbing and Utilities Water Distribution.

This review exercise will ensure that all assets are accepted and are being maintained after handover. This also provides the owner’s personnel an opportunity to become familiar with the new assets being added to their stewardship and to establish preventive maintenance (PM) procedures and/or to apply standing PM’s to these newly uploaded assets.
Following notification to the owner, each end user shall have thirty (30) calendar days to review assets and schedule a meeting with the Facilities Data Integrator (FDI) and Owner to address any concerns and/or corrective actions that may be needed. If data concerns/issues have not been provided in writing to the Facilities Data Integrator within this 30 day period, acceptance by the end user shall be considered to be confirmed. The Facilities Data Integrator will be responsible to develop and submit a schedule to the Owner for how end user concerns (if any) will be resolved.

Owner Review and Acceptance

Following End User Review and Acceptance, the Owner is responsible to review and provide final comments for the Facilities Data Integrator to address with AEC team. If no comments have been received by the Owner within thirty (30) calendar days of end user acceptance AND completion of final punch list items, Owner acceptance shall be granted to the FDI. This process should generally follow overall project substantial and final completion to ensure that all team members remain engaged in the FM data process.

AEC Team Final Handover

Per the BIM Execution Plan, regularly scheduled COBie data and document submissions will be reviewed and reported on by the Facilities Data Integrator at the agreed upon review intervals.

At the final scheduled COBie report, the Facilities Data Integrator shall provide the AEC team and Owner a final punch list to address all outstanding items in the COBie data to be corrected. If all outstanding items have not been completed within the subsequent fourteen (14) calendar days, the owner may elect to take reasonable corrective actions as outlined in other parts of these specifications.

AEC team members that are contracted for COBie deliverables are responsible to validate (i.e., verify by their own means and methods) their own work prior to regularly scheduled submissions to the FDI. This will greatly shorten Corrective Action reports provided by the Facilities Data Integrator and the meetings allocated to review these reports with the AEC team on a prescribed and regular basis. The basic premise here is that progressive elaboration and “building up” of the FM data occurs over multiple phases of the project duration.

Final Handover Deliverables Include (but may not be limited to):

- Project team compliance and conformance to the FM Data requirements (the FM Data Specification).
- COBie Version 2.24 file (latest approved version) with all documents in one folder.
- Record Set/As-built models (including all native files and one federated NWD file).
Facilities Model with saved viewpoints of all COBie components per the FM Data requirements (the FM Data Specification).

Coordinate the BEP development with each of the following and all parts of Exhibit E.

Exhibit 3 – Section 3 – FM Data Requirements

- Exhibit 3.A – Responsibility Assignment Matrix (RAM) with Mapping (XLS File)
- Exhibit 3.B – Facilities Data Integrator (FDI) Role

Role: Facilities Data Integrator (FDI)

Description: Manager of BIM for FM Process on Design/Construction Projects

Overall Responsibility: Ensure correct execution of the TAM-HSC BIM for FM Requirements

Specific Responsibilities Include (but are not limited to):

Planning / Programming Phase

- Determine feasibility of FM data collection for proposed projects.
- Confirm FM data requirements are to be employed on certain design/construction jobs.
- Update (if needed) and provide latest BIM for FM requirements to new projects.
- For unique projects, reconcile the FM requirements and update the FM requirements.
- Setup project responsibilities and roles per Owner’s directives and BIM for FM requirements.
- Integrate FM data requirements into the project delivery process for RFQ, RFP, and other contracting processes for the design, construction, commissioning, and other team members.
- Establish budget allocations in the capital budget for FM data functions on the project.
- Review and assess project team members (i.e., AEC teams) for their ability to comply with requirements (via RFQ and RFP activities) and the review of “draft” BIM Execution Plans.
- Other duties as required to implement the TAM-HSC BIM and FM requirements and specifications.
Design / Construction / Commissioning Phases

- Hold kick-off and orientation meetings detailing BIM for FM requirements.
- Review and assess submitted BIM Execution Plans from AEC project team members.
- Hold meetings for BIM for FM Execution Plan review and project coordination planning including deliverable schedules.
- Adjust AEC team BIM for FM scope, if necessary, and in accordance with Owner’s directives and specific or unique project requirements not listed in the latest FM data specifications.
- Monitor progress, assess quality, and confirm accuracy of ongoing data collection and validation process.
- Hold regular project meetings with project team members to discuss the progress and quality of the deliverables and the schedule for incremental deliverable development.
- Conduct payment application reviews of the FM data deliverables for AEC payment process.
- Inspect and evaluate (i.e., grade) deliverables in accordance with BIM for FM requirements and project schedules.
- Integrate owner data into project data set, as applicable for OFOI / OFCI assets.
- Integrate project team data deliverables into latest acceptable COBie format for test uploads to CMMS (AiM).
- Conduct several incremental / test uploads to AiM to confirm data migration is functional. If not functional, take corrective actions as needed.
- Ensure facility models are setup for O&M facility viewer and integration with CMMS model linking functions.
- Provide necessary minor adjustments to models to make them lighter and user friendly for O&M purposes (ex: transparent ceilings and site ground, contrast colors appropriately, etc).
- Other duties as required to implement the TAM-HSC BIM and FM requirements and specifications.

Qualifications for the Facilities Data Integrator (FDI) Role

- Any team member (Architect, Engineer, General Contractor, Consultant, Commissioning Agent, or Owner’s Representative, etc.) that can show successful management of past FM Data (specifically, the COBie 2.24 format) projects that
have been imported to a client’s (i.e., owner’s) CMMS and are currently in use for Asset Management functions.

- provide references of qualifying projects
- provide references of owners/clients currently using the imported COBie formatted data for Asset Management

- Any team that can demonstrate understanding of the TAM-HSC BIM for FM requirements and provide an example for how each section is carried out using a sample higher education project of their choice. Samples should include the following, at a minimum:
  - COBie sample files shall successfully import to TAM-HSC AiM and include a minimum of the following for sample data sets: 10 contacts, 5 spaces, 1 zone, 5 types, 10 components, 2 systems, 10 documents, and 15 equipment attributes matching the most current TAM-HSC requirements.
  - Ability to complete the TAM-HSC BIM Execution Plan outlining their role as a Facilities Data Integrator on the sample project.

- It is recommended that the Facilities Data Integrator (FDI) chosen for a specific project not be someone who already has a substantial responsibility with BIM for FM data production (authorship) on that project. This would typically exclude the AEC team from functioning as the FDI. This criteria allows for objectivity (independent verification) and helps to prohibit a conflict of interest in the evaluation (grading) functions by the FDI.

- Exhibit 3.C – Asset Type Matrix

- Exhibit 3.D – FM Model Criteria

A valuable part of the BIM process, models provides opportunity to improve communication during planning, design, construction, and operations. Outstanding implications exist for the use of models in facilities management. Because of this, models are being employed as a management tool at Texas A&M Health Science Center (TAM-HSC). Desiring to always improve, TAM-HSC is committed to the innovative use of tools such as models that help staff to better steward facilities. A continued improvement of operational workflows is an expected result from the use of model deliverables.

The intent of this section is to include the minimum criteria for 3D models as they relate to the BIM for FM Deliverables alone. This section does not replace or lessen modeling criteria in other sections of TAM-HSC specifications or contract requirements related to other BIM Use Cases (applications of BIM for other objectives).

1. Native Files from As-Built / Field Coordinated Model
A. The construction contractor shall provide two versions of the native files that support the as-built / field coordinated model at multiple times before project closeout and at substantial completion. These files are the model instances that build the federated coordination models. One version shall be the native files saved from the design / trade software it was created in. The other version shall be the interoperable / sharing formats from the design / trade software it was created in. Examples of interoperable formats include: LandXML, gbXML, DWG, IFC, ASCII, FBX, etc. The intent for design / trade files and interoperable formats is to allow opportunities for integration in future design work, allowing for record update with field changes, visualization projects, and much more. Native files may be requested from the FDI on an ongoing basis for review for owner application. Specific interoperable formats will be determined by the FDI during the BEP phase.

2. FM Model

A. The construction contractor shall provide two versions of the as-built / field coordinated model in re-savable NWD format at multiple times before close-out (per the BIM Execution Plan) and at substantial completion of the project. As-built models shall at a minimum include all components represented in the COBie deliverable for spaces and components (named equipment). Exception to this shall be all building level assets (clocks, seating, faucets, etc.), fire initiating and indicating devices, and BAS sensors.

B. One version of the NWD provided model shall be the final as-built model per the field coordination effort.

C. The second version of the NWD model shall be optimized (stripped down and lightweight) for Facilities Management use. Optimization shall allow for easy navigation and viewing of assets. Particular optimization shall include, but not be limited to, ceilings at fifty percent transparency and the hiding of all doors. Also, included shall be the unique color-coding of all building systems (electrical, chilled water, heating water, domestic water, etc.) per the current TAM-HSC coloring schema. The coloring schema shall be documented in the BIM Execution Plan as well.

D. Each component in COBie shall have a minimum of one saved viewpoint in the model. Exception to this shall be all building level assets (clocks, seating, faucets, etc.), fire initiating and indicating devices, and BAS sensors. These saved viewpoint files shall be attached to the component in the documents portion of COBie. Each viewpoint shall provide good perspective of the component and its associated context. Each viewpoint should be named according to the component and shall match exactly. These viewpoint file format will be .XML.
General Requirements

Terms & Definitions

The Texas A&M University System

The Texas A&M University System is composed of several universities, a health science center and several agencies.

All A&M System construction projects are assigned a two part System Project Number for identification. The first number or prefix is used to indicate which part of the system the project pertains and the last part is a unique four digit number.

The Project Number shall appear on all documents relating to the project. In the event Federal funds are involved, a separate Federal number will be assigned. All references to "Project Number" in that case would refer to both Federal and System numbers.

Prefix numbers are as follows with parenthesis indicating approved abbreviation:

01 - The Texas A&M University System (A&M System)
02 - Texas A&M University (Texas A&M)
03 - Not Used
04 - Tarleton State University (Tarleton)
05 - Prairie View A&M University (PVAMU)
06 - Texas AgriLife Research (AgriLife Research)
07 - Texas AgriLife Extension Service (AgriLife Extension)
08 - Texas Engineering Experiment Station (TEES)
09 - Texas Engineering Extension Service (TEEX)
10 - Texas A&M University at Galveston (TAMUG)
11 - Texas Forest Service (TFS)
12 - Texas Transportation Institute (TTI)
13 - Not Used
14 - Not Used
15 - Texas A&M University-Corpus Christi (A&M-Corpus Christi)
16 - Texas A&M International University (TAMIU)
17 - Texas A&M University-Kingsville (Texas A&M-Kingsville)
18 - West Texas A&M University (WTAMU or West Texas A&M)
19 - Not Used
20 - Texas Veterinary Medical Diagnostic Laboratory (TVMDL)
21 - Texas A&M University-Commerce (A&M-Commerce)
22 - Texas A&M University-Texarkana (A&M-Texarkana)
23 - The Texas A&M Health Science Center (Texas A&M Health Science Center)
24 - Texas A&M University-Central Texas
25 - Texas A&M University-San Antonio
General Requirements

Office of Facilities Planning and Construction

The Office of Facilities Planning and Construction (FPC) is a part of the A&M System Offices (SO) and manages all major construction projects for the A&M System and reports to the Chancellor of the A&M System. For the purposes of this document FPC is also the Owner.

Facilities Planning and Construction is located on the second floor, of the Moore Connolly Building located at 301 Tarrow in College Station.

Executive Director, Facilities Planning & Construction is responsible for the administration, planning and construction of projects for the A&M System. The staff consists of the following:

Assistant Director is responsible for assisting the System Members with pre-planning assistance, preparation of project Program of Requirements and managing assigned campus master plan projects.

Area Manager is responsible for the daily coordination and project management of the projects assigned to their teams and for successfully completing all projects in their region of the State.

Project Managers are responsible for managing the design and construction phase under the leadership of the Area Manager and coordinating the activities of their team in accordance with policies and procedures established by the Department.

Interior Designer is responsible for managing the furnishings programming, selection and installation and working with the Architectural Project Managers to ensure the designs accommodate the required furnishings.

Area Manager for Engineering is responsible for coordinating the activities of discipline specific System Engineers and Engineering Inspectors to assist the Area Managers during design and construction.

System Engineer is responsible for providing discipline specific engineering knowledge to assist the Area Managers and their teams during design and construction.

Engineering Inspector is responsible for inspecting their discipline specific aspect of the Work.

System Offices
Office of HUB and Procurement Services

The Office of HUB and Procurement Programs is a part of the A&M System Offices and is responsible for identifying and promoting the use of Historically Underutilized Businesses on projects managed by Facilities Planning and Construction. The Office of HUB and Procurement Services will assist the design teams and contractors in meeting their HUB Goals.

HUB and Procurement Programs also oversees the procurement of other design and construction related services such as Construction Testing, Commissioning, Air Balancing and Furnishings.

Office of Safety

The areas of health and safety, fire and life safety, environmental stewardship, and security are all governed by the Office of Safety.

The Fire and Life Safety group of the Environmental Health and Safety Department is dedicated to helping the Texas A&M University community be a safer place to work, study, live, and play. This group conducts fire safety inspections of campus facilities, assists in the development and implementation of emergency evacuation planning and inspects, maintains, and provides training in the proper use of portable fire extinguishers. In addition, the group also conducts plan reviews of new construction projects as well as renovation projects and assists with testing of all fire detection/suppression systems to ensure compliance with nationally recognized codes and standards.

Environmental & Hazardous Waste Management assists the university in ensuring protection for the environment and compliance with federal, state, and university environmental protection policies, rules, and regulations.

System Members

Chief Executive Officer is defined as the President of an academic institution (Texas A&M University, Prairie View A&M University, Tarleton State University, Texas A&M University-Corpus Christi, Texas A&M University-Kingsville, Texas A&M International University, West Texas A&M University, Texas A&M University-Commerce, Texas A&M University-Texarkana and Texas A&M Health Science Center) or the Director of other parts of the System.

User or Using Agency is the academic institution or agency that will use the completed facility.
**General Requirements**

**User Coordinator:** The individual designated by the User or Using Agency as its representative during the programming, design and construction of the project. The User Coordinator will serve as the contact and representative of the department, university or agency and will be responsible for coordinating the procurement of special equipment, telephone installation and scheduling the relocation of equipment and/or personnel to/from the spaces affected by the construction. The User Coordinator has no contractual or approval authority with regards to the design and construction agreements.

**Other Definitions**

**Project:** The term "Project" may include the construction of any building or any structure or any facility or utility appurtenant thereto, including fixed equipment and furnishings thereof, and of any addition to, alteration, rehabilitation or repair of any existing building or any structure, or any facility or utility appurtenant thereto.

**Program of Requirements** (POR) is prepared for the project by the Project Planning Division, by a firm contracted by FPC to develop the POR or by the Project A/E as a reimbursable service. The POR shall be based on input from the User or Using Agency and/or the User Coordinator and approved by the CEO of the Using Agency. The POR is the single written source of information concerning the scope of the project and the detailed requirements to be achieved by the project. The POR identifies the project specific elements to be included in the new and/or renovated facility. It establishes basic design criteria and shall be verified by the A/E through meetings with the Users during the Schematic Design phase of the project. The POR is to be used in conjunction with the Facility Design Guidelines and the Services Agreement to establish the overall responsibilities of the design and construction team.

**Contractor:** The individual, corporation, company, partnership, firm or other organization that has contracted to perform the Work under the Contract with the Owner.

**Record Drawings** are the contract drawings, modified and/or corrected to incorporate all changes made during construction.

**Additional Definitions** can be found in Article I of the "Uniform General and Supplemental Conditions", located in the Appendix section of this manual.

**ADMINISTRATIVE PROCEDURES & REQUIREMENTS**

**General**

At anytime during the course of the project the A&M System reserves the right to
contract on its own any of the services required to complete the project.

**Payment Schedule for A/E, CMAR and D-B Services Agreement**

Payments to the A/E, CMAR and D-B for work completed will be made in accordance with the Services Agreement. All invoices shall be submitted through e-Builder and shall be accompanied by a completed Progress Assessment Report (PAR).

**Authorization for Reimbursable Services**

The Services Agreements contain several items that are reimbursable services. Even though these items are listed in the Services Agreement they still need to be authorized by the Owner prior to execution of the services. The A/E, CMAR and D-B must forward to the FPC Project Manager a proposal for the services with a not to exceed amount from the consultant/vendor. The cover letter should summarize the amount. The FPC Project Manager will review the proposal and if the total amount is within the amount listed in reimbursable services of the Services Agreement the FPC Project Manager will authorize the service in writing. Many of the reimbursable items like site survey, soils investigation and rendering will be authorized with the instruction that there will be one “lump sum” payment made at the successful completion of the task. Other reimbursable items like special consultants, whose work is incorporated into the design documents, will be authorized and the amount will be paid by project milestones as indicated in the A/E Services Agreement or in the proposal acceptance letter.

If the proposed reimbursable services amount exceeds the amount listed in the Services Agreement than the authorization will come from the Director of Project Delivery and the reimbursable amount in the Services Agreement will be modified by a change order to the agreement.

Upon completion of a “lump sum” reimbursable item the A/E, CMAR and D-B must submit an invoice to the FPC Project Manager for payment. The invoice must be from the A/E, CMAR and D-B and contain as backup a copy of the consultant/vendor’s invoice. The cover letter must indicate that the services have been performed to their satisfaction and are complete.

If due to extenuating circumstances a “lump sum” reimbursable service is not able to be completed the Owner will entertain a partial payment. The A/E, CMAR and D-B must send a letter to the FPC Project Manager explaining the circumstances, indicating the amount of work complete and suggesting a partial payment amount. The FPC Project Manager will review this request with the Area Manager. Upon the concurrence of the Director of Project Delivery a partial payment will be made.

**Authorization for Additional Services**
The Services Agreements states the conditions for which the A/E, CMAR and D-B may receive compensation for additional services.

If the A/E, CMAR or D-B foresees that additional services should be performed because of instructions received, or unusual circumstances, they shall submit a change order through e-Builder. The additional services shall not be performed or contracted by the A/E, CMAR or D-B until the change order has been approved.

**Approvals/Notifications**

At each step in the design process the A/E, CMAR and D-B must receive approval from the Owner prior to proceeding to the next step. These approvals take different forms and can vary due to project complexity. Generally, the A/E, CMAR and D-B will be authorized to proceed by the following:

1. **Begin Design**: Letter transmitting fully executed Agreement
2. **Schematic Design**: Approval Letter for Schematic Design
3. **Design Development**: Approval Letter for Design Development
4. **Construction Documents**: Approval Letter for Construction Documents
5. **Construction Phase**: Issuance of Notice to Proceed with Construction Services

On all projects the Schematic Design approval letter will come from the Area Manager. The larger and more complex projects will have an approval letter that will be first routed through the campus or agency administration for their approval prior to our approval of Schematic Design. This approval routing will also contain letter and/or tabloid size color copies of the project site plan, floor plans and exterior appearance.

The approval process for Design Development begins with an approval letter, along with letter and/or tabloid size color copies of the project site plan, floor plans and exterior appearance, that will be first routed through the campus or agency administration for their approval.

The approval process for Construction Documents begins with an approval letter, along with letter and/or tabloid size color copies of the project site plan, floor plans and exterior appearance, that will be first routed through the campus or agency administration for their approval.

At a point after the completion of Design Development and prior to the acceptance of a GMP or the award of any construction contract the project will be presented by the Chief Financial Officer and Treasurer to the Board of Regents for approval.

If reviews or approvals of documents are required by Federal agencies, the A/E may be expected to make necessary presentations with Facilities Planning Division’s assistance.
Distribution of Documents

The A/E shall furnish the FPC Project Manager the number of sets of documents as identified in the A/E Agreement at each step of the design process. The documents sent to FPC Project Manager are reviewed by FPC personnel and the documents sent to the User Representative are reviewed by representatives from the using department, Physical Plant personnel, Safety & Health personnel, Campus Police personnel, etc.

Correspondence and Reports

Communications between all parties involved in the planning and construction of a project is a requisite. Oral communications, instructions, directives, and minutes of conferences shall be confirmed in writing by the A/E and distributed to those involved in the planning and construction within five (5) working days of the meeting date.

The Project Architect/Engineer is expected to provide leadership of all design meetings and provide minutes of each meeting within five (5) working days. The meeting minutes shall separately indicate all decisions made at the meeting and all items requiring a decision, which party has responsibility for the decision and when the decision is required.

All correspondence and reports shall be dated and show clearly the project number, the name of the project, the Part of the System, the location, and the A/E contract number, if pertinent.

All correspondence and reports shall be addressed to the Project Manager of FPC during the design phase and construction Phase.

Pending Issues Report

The Project A/E shall prepare and maintain a Pending Issues Report throughout the Schematic Design, Design Development and Construction Documents phases of the project. The report shall document all items requiring decisions on the part of the design team, FPC and the User. The report shall be updated at least monthly during the course of the project and also provided along with meeting minutes from the milestone reviews.

Data Furnished to A/E

The A/E will be furnished a copy of the Program of Requirements (POR) unless the POR development is included as a reimbursable service in the A/E Agreement, existing campus master plans and other studies and reports, soil investigation reports from surrounding buildings if available, existing utility information and existing building
information if the project involves renovation.

**Changes in Design**

There shall be no changes made in the Scope of Work, Area Requirements, or Project Cost without approval of the FPC Project Manager. During the design process the A/E shall maintain a listing of all spaces listed in the Program of Requirements and their square footage. The listing will begin with the POR spaces and be updated at each design milestone.

Major changes to the spaces in an approved POR shall be approved by the Using Agency CEO.

**Schedule of Planning**

The POR for each Project contains a time schedule indicating dates for all project milestones. It is very important that these dates be followed as close as possible since it can be very difficult to reschedule around all parties existing business schedule. If changes must be made the A/E must notify the FPC Project Manager several weeks in advance. Deviations from the POR time schedule will only be made when mutually agreed to by the User, the A/E and the FPC Project Manager.

Under special conditions, the planning schedule may be dictated by the need for the Owner to place a completed project in service by an established date deadline. This may occur as a result of grant restrictions, land use or deed restrictions, or a critical need for the facility to be placed in operation to meet semester schedules. In this event, a specific construction completion date will be established by the FPC Project Manager, and the various planning stages shall be scheduled from that date.

Should the A/E find that the dates of the Planning Schedule cannot be met, they shall give prompt notice in writing to the FPC Project Manager.

**Reviews**

The review of any drawings and specifications by the Owner and others does not relieve A/E of any responsibility nor do they constitute approval of drawings and specifications to that date.

**Drawing Requirements**

The Project A/E shall produce the design for this project using Building Information Model (BIM) authoring software capable of producing IFC compliant files. The Project A/E shall begin using BIM as early in the design process as possible but no later than
General Requirements

the drawings required for Design Development submittal. The A/E is encouraged to use BIM to verify compliance with the POR. Maximum drawing sheet size is restricted to ANSI E size - 34” x 44”. Lettering is to be of sufficient size so it can be easily read when reproduced full size and half size. Minimum size of letters on any full size printed drawing is 1/8”. Use only the standard fonts supplied with the Microsoft Windows OS. On all drawings, provide a graphic scale in addition to the standard inch scale. On all plan sheets provide a north arrow and if a plan is divided over multiple sheets provide a key plan adjacent to the sheet number in the title block. Do not use the word "PROPOSED" in designating new work. All work shown on drawings shall be assumed to be new unless designated as existing.

All drawing sheets shall comply with the following sheet numbering format.

```
A - N n n
```

Where “A” is the discipline designator, “N” is the drawing sheet type designator, “nn” is the sheet number.

The following are the discipline designators as well as the order the drawings shall be placed in a set.

- G - General
- H - Hazardous Materials
- C - Civil
- L - Landscape
- S - Structural
- A - Architectural
- I - Interiors
- Q - Equipment
- F - Fire Protection
- P - Plumbing
- M - Mechanical
- E - Electrical
- T - Telecommunications
- R - Resource
- X - Other Disciplines
- Z - Contractor/Shop Drawings

The following are the drawing sheet type designator.

- 0 - General
- 1 - Plans
- 2 - Elevations
- 3 - Sections

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4 - Large Scale Views
5 - Details
6 - Schedules and Diagrams
7 - User Defined
8 - User Defined
9 - 3D Representations

Title block shall be on the right side of the sheet extending the entire height of the sheet. All text in the title block can be orientated horizontally or vertically.

The title block shall include at a minimum, beginning from bottom of title block to top:

- Sheet number (minimum ½” text height)
- Sheet Title
- TAMUS Project Number (minimum 3/16” text height)
- Building Inventory Number (minimum 3/16” text height)
- Drawn by
- Checked by
- Name of Project
- Campus or Agency
- Location
- Firm name of Architect/Engineer under contract with owner and consultant if applicable
- Seals

All documents must be sealed or have the appropriate designation per respective licensing board rules.

Cover sheet for the drawings shall contain

- Name of the project
- The university or agency name
- The A&M System project number
- Date
- The design team names and addresses
- Copy of the project rendering or the campus/agency seal.

General Information Sheet shall contain

- Location Map showing contractor’s route, construction limits and contractor lay down area
- Index of drawings
- Abbreviations used in the project

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- Net and Gross square foot per floor with total and alternates separate
- Code, Structural, Mechanical, Plumbing and Electrical Design criteria
- Symbols and Legend unique to the project. Unused symbols shall not be included. Where symbols imply a specific data and/or telecom outlet provide a detail of the outlet.

Room numbers shall be part of the parametric data automatically assigned to objects by placement in rooms.

Detailing shall be adequate, with sufficient schedules, keys to materials, symbols and notes to clearly indicate the work required. Abbreviations shall be held to a minimum.

All schedules shall be derived from the BIM(s) by extracting parametric data associated with the objects used in the model.

All required details will be shown on the drawings, not in a separate manual.

All references to other disciplines shall indicate the appropriate sheet and detail.

Room finish, door and window schedules shall be on the drawings.

All items of mechanical and electrical equipment such as air handlers, pumps, fans, panelboards, light fixtures, etc. shall be scheduled on the drawings. Include all appropriate design and operating parameters for each unit. All of this data shall be attached to the associated objects as parametric data.

Electrical panelboard schedules shall list all unique characteristics of each panelboard including but not limited to each breaker size, the loading of each circuit, circuit number, wire size, main breaker size, bussing, interrupt rating and load summary. Schedules that list quantities of breakers without scheduling each circuit shall not be used. All of this data shall be attached to the associated objects as parametric data.

All panelboards, switchboards, transformers and other major electrical equipment shall have a unique identifier or tag. Panelboards shall use the following numbering scheme:

\[
\text{x pn}
\]

Where “x” is the floor number the panel is located on.
Where “p” is the panel type using “L” for low, “H” for high and “E” for emergency.
Where “n” is the panel sequence number.

Electrical oneline diagram shall show in an oneline format all medium voltage equipment including manholes, switchgear, transformers and cables. The 600 volt and below system shall be detailed to the branch circuit panelboard level. The size of all wire,
conduit, breakers, starters, transformers, generators, meters and transfer switches shall be indicated. Tables may be used. The sizing of wire and conduit using only panel schedules will not be accepted.

Ground riser diagram shall show the size and interconnection of all grounding systems. In most cases ground conductors shall be sized larger than required by the National Electrical Code.

Telephone riser diagram shall show all riser cables, conduits, sleeves and line protectors in their relative relationship to the building.

Fire Alarm riser diagram shall show all equipment associated with the fire alarm system.

Broadband distribution riser diagram (Cable Television) shall show all cable sizes, riser cables, amplifiers, splitters, outlets and head end equipment as may be required.

Lightning protection system drawing(s) shall show the arrangement of the lightning protection system with details for each unique connection and roof penetration. These details shall be coordinated and compatible with the roof system.

**Specification Requirement**

Specifications shall include bidding and contract documents and technical specifications and the bound document will be entitled "SPECIFICATIONS."

The importance of accurate, complete and coordinated specifications is very important. Specifications shall be carefully checked to include all items pertaining to the project and to eliminate inclusion of items not incorporated into the project.

Specifications shall follow CSI Masterformat 2004 and be prepared on 8 1/2" x 11" paper with contents arranged in order indicated below.

Project A/E may use descriptive or performance type of specifications, naming three products by name, catalogue number and manufacturer which will meet the standards required. Care shall be taken not to adopt wording recommended by a single manufacturer if the wording will require unique or patented features of a product.

**Throughout these Guidelines under Campus Specific Information there are references to single products and/or manufacturers. These are NOT sole source items. The project A/E is required to identify and include in the documents other products and/or manufacturers that are equal.**

In the various specification sections where the specification is based around the
performance of a specific product or model from a manufacturer (for example fixed seating, laboratory casework, laboratory equipment, air handlers, etc.) all other manufacturers listed as approved equals must also indicate comparable model numbers.

Details and schedules shall be shown on the drawings and not in the specifications

Specifications written "Install in accordance with the manufacturers specifications" are not an acceptable specification. Spell out the procedure to be used so that the FPC Project Inspector and the Contractor's Superintendent can ascertain from the Specifications the manner in which a product is to be used or applied without reference to numerous catalogues which may not be handily available.

Scope of work shall be accurately defined in each section; reference all allied work provided under other sections of work.

Clearly define work to be included under each applicable alternate in each section of work.

Omit duplication of specifications included under Uniform General and Supplemental Conditions or Special Conditions; in each instance, reference the applicable paragraph by number and expand or modify the requirement only as necessary to accomplish a specific purpose. (This is particularly applicable to Mechanical and Electrical sections).

Require delivery, acceptance and approval of all "Certificates of Manufacturer's Quality Control" before delivery of applicable equipment or material.

The specification cover shall contain the following information

- Title: "SPECIFICATIONS."
- Project Number (including Federal project number, if applicable)
- Name of Project.
- Name of University or Agency.
- Location of Project.
- Owner: "THE TEXAS A&M UNIVERSITY SYSTEM."
- Set number.
- Firm name of A/E.
- Date (same as drawings).

The title page in the specifications shall contain the following information

- Title: "SPECIFICATION."
- Project Number (including Federal project number, if applicable).
- Name of Project.
The color coding and duplexing requirement for the specifications is as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Provided By</th>
<th>Paper Color</th>
<th>Special Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cover</td>
<td>A/E</td>
<td>A/E's Choice</td>
<td>One-sided, cover stock. Back cover same material and color.</td>
</tr>
<tr>
<td>2</td>
<td>Board of Regents Title Page</td>
<td>FPC</td>
<td>White</td>
<td>One-sided.</td>
</tr>
<tr>
<td>4</td>
<td>Table of Contents</td>
<td>A/E</td>
<td>White</td>
<td>Two-sided.</td>
</tr>
<tr>
<td>5</td>
<td>Schedule of Drawings</td>
<td>A/E</td>
<td>White</td>
<td>Two-sided.</td>
</tr>
<tr>
<td>6</td>
<td>Request for Competitive Sealed Proposal (CSP ONLY)</td>
<td>FPC</td>
<td>White</td>
<td>Two-sided.</td>
</tr>
<tr>
<td>7</td>
<td>Instructions for Competitive Sealed Proposal (CSP ONLY)</td>
<td>FPC</td>
<td>White</td>
<td>Two-sided.</td>
</tr>
<tr>
<td>8</td>
<td>Supplemental Instructions for Competitive Sealed Proposal (CSP ONLY)</td>
<td>FPC</td>
<td>White</td>
<td>Two-sided.</td>
</tr>
<tr>
<td>9</td>
<td>Bid/Proposal Bond (CSP ONLY)</td>
<td>FPC</td>
<td>White</td>
<td>One-sided. Provide two loose copies of this with proposal package to each General Contractor for bidding purposes.</td>
</tr>
<tr>
<td>10</td>
<td>Part 1, Competitive Sealed Proposal (CSP ONLY)</td>
<td>FPC</td>
<td>White</td>
<td>One-sided. Provide two loose copies of Parts 1 with proposal package to each General Contractor for bidding purposes.</td>
</tr>
<tr>
<td>11</td>
<td>Parts 2 and 3, Competitive Sealed Proposal (CSP ONLY)</td>
<td>FPC</td>
<td>White</td>
<td>One-sided. Provide one loose copy of Parts 2 and 3 with proposal package to each General Contractor for bidding purposes.</td>
</tr>
</tbody>
</table>
Federal General Requirements

One copy of each form required by the Federal Agency concerned (General requirements, wage rates, certificates, etc.) shall be bound into the Specifications on Projects involving Federal funds.

FPC Project Manager will furnish one copy to the Project A/E for his use in reproducing necessary copies.

Alternates (CSP Only)

Provide a description of each Alternate.

Additive alternates are required for projects not involving Federal funds. For Federally funded projects deductive alternates are generally required and must be listed in order of acceptance.

Unit Prices (CSP Only)

Used for added depth of piers and pier casing only

Provide for cost separations of items, units, etc. as directed by the FPC Project Manager.
Addenda

Addenda shall be reserved for items inadvertently omitted from bidding documents. Documents shall be prepared in a comprehensive and a complete manner without use of Addenda.

Addenda sheets shall be 8-1/2" x 11", or the same size as those of the bid set drawings, numbered in sequence with the prefix "AD" and the date of issue and other required identification of the project.

Printing and Binding Requirements

All drawing review sets shall be securely bound using staples or screw post. All reports required for reviews shall be bound with spiral binding or in a 3-ring binder.

All bid set drawings shall be securely bound using staples or screw post. All bid set specifications, except for 10 copies, shall be securely bound using long staples, "VELO" plastic strip, or screw posts and securely taped (ring, spiral or GBC bindings are not acceptable).

The 10 unbound sets of Specifications will be used as the actual contract documents and shall be delivered to the FPC Project Manager. These ten sets shall not be punched or bound in any manner of fashion.

Electronic Drawing Files

Digital files shall follow a layer/level format that complies with the AIA CAD Layer Guidelines. The A/E shall provide a hard copy listing of all files, levels, reference file, etc. All items in digital files shall be drawn to full scale.

BIM files shall be divided by discipline/trade. Splitting models not allowable except when approved in writing by the FPC project manager. When drawings need to be split that split shall be vertically not horizontally.

Object libraries for all models shall be included with the model files. This is especially important for IFC files.

BIM files shall be provided in their native format as well as IFC. The IFC files shall be optimized prior to submission. Model files shall be named in the following format:

A B - C E F G H I J K L M N O P Q R S . T U V
General Requirements

A-B - Campus Number
C-G - Project Number
H-K - Building Number (if required)
L-O - Abbreviated Project Name (add more letters if needed)
P-S - Discipline (Arch, Elec, Mech, etc)
T-V - File Extension

In cases where there are more than one building involved in the project the building number shall be used after the project number to differentiate between the two.

During the course of the design digital files are required by FPC Interior Designer for furnishings layouts and by Project Controls Division to update campus maps for illustration purposes. These digital files shall be made available to FPC Project Manager (two weeks before each meeting) at the following project milestones:

1. Design Development (architectural floor plans & site plan)
2. 50% Design (architectural floor plans only)
3. 75% Design (architectural floor plans only)
4. 100% Design (architectural floor plans & site plan)

Electronic File Names

DWG and PDF files will be required for all sheets in the drawing sets. The file names used for all digital files delivered to Facilities Planning and Construction shall follow the following format.

A B C D E - F G H I J K L M N O P Q R S T

A-C - Sheet Number (This refers to the overall number in the set)
D-E - Campus Number
F-I - Project Number
J-M - Sheet Number
N-Q - Sheet Name
R-T - File Extension

Electronic Folder Names

An electronic folder structure has been established by FPC. This structure along with example file names shall be provided by the FPC project manager.

Record Drawings

All changes during the course of the design and construction shall be incorporated into
General Requirements

the BIM(s). The A/E is responsible for making changes through the issue of all addenda at which point the model(s) will be turned over to FPC and the GC/CM. The A/E shall also be responsible for providing updates to the model(s) that are changed through RFI, ASI, CCD, Approved Proposal Request. The GC/CM shall be responsible for maintaining and updating the model(s) after the issue of the final addendum. The model(s) shall be maintained as the as-built model(s) from which the record drawings will be derived.

Deliver to the OWNER two (2) copies of all drawings in DWG and PDF format, native model files, as well as IFC file format, corrected to be “Record Drawings” on disk type media (DVD or CD). The disk shall be labeled with a pre-printed label that contains the name of the project the university/agency, the project number, GC/CM name, and the A/E firm name. No other digital format will be accepted. Scanning of drawings is not acceptable.

The digital version of the record drawings shall have one digital drawing file for each drawing sheet in the project bid set. All reference files and “xrefs” must be inserted into the final digital file.

COBie Data Sets

The GC/CM is required to submit data in the most current version of COBie. Assembly of the COBie data requires that the A/E, GC/CM, and commissioning agent provide or even input data into either the BIM(s) or a MS Excel spreadsheet. The GC/CM is responsible for coordinating and compiling this data. The preferred method for assembling the data is by deriving/extracting the data from the BIM(s).

For more information on COBie refer to The Whole Building Design Guide. http://www.wbdg.org/resources/cobie.php

Cost Control

In the Program of Requirements the project scope matches the "Base Bid Scope" line item on the Estimated Project Budget page. To achieve an awardable project, the base bid represents 90% of the funds available to award a construction contract. The Project A/E is required by contract to work with the Users and the Facilities Planning Division to keep the design within the “Base Bid Scope” and identify additive alternates to utilize all project funds. Deductive alternates will not be considered.

Throughout the design process, the Project A/E and Construction Manager at Risk or Design-Build Contractor will be required to furnish knowledgeable cost estimates for all items of construction. These estimates shall be itemized in sufficient detail so as to allow the University to make informed choices when questions of priority are considered to include or exclude an item. The A/E shall share the BIM(s) with the CM. The CM is encouraged to use these models for establishing conceptual pricing.
Coded Estimate System

Code A Estimate: Based on completed Program of Requirements.

Code B Estimate: Based on and submitted with completed Schematic Design (A/E, CMAR, D-B responsibility). The estimate detail shall be in Uniformat 98 (Assemblies) format.

Code C Estimate: Based on and submitted with completed Design Development (A/E, CMAR, D-B responsibility). The estimate detail shall be in Uniformat 98 (Assemblies) and Masterformat 2004 format.

Code D Estimate: Based on and submitted with completed Construction Documents (A/E, CMAR, D-B responsibility). The estimate detail shall be in Masterformat 2004 format.

Code E Estimate: Submitted 10 days prior to Bid Opening (CSP Only); based on changes in Construction Documents and other events that have occurred since Code D estimate was submitted. For the Code E estimate, if there is a major change in the estimate from the Code D estimate the A/E shall also provide the estimate detail in CSI Masterformat 2004, otherwise only the summary is required.

The Project A/E is cautioned not to confuse the design contingency indicated on the team’s estimate with the Bid Contingency (CSP Only) indicated in the POR. These numbers are not the same. Based on the level of completeness of the design there will be a design contingency percentage that is included by estimators. This percentage will decrease as the design proceeds towards the Construction Documents review. The Bid Contingency number is only for variations in the bidding market that were not anticipated by the A/E team’s estimator and to purchase additive alternates.
Cost Estimate Format

(THE ARCHITECT/ENGINEER WILL NOTE THAT THE CONSTRUCTION COST IS ONLY A PART OF THE PROJECT COST. THE A/E SHALL SUBMIT COST ESTIMATE IN THIS FORMAT ONLY. USE ONLY ITEMS APPLICABLE TO THE PARTICULAR PROJECT. DO NOT USE "N/A." CHANGE NUMBER SEQUENCE IF A CERTAIN LINE ITEM IS OMITTED.)

(Project Name)                                       Project No.
(System Member)                                    Date
(City)

CODE "___" COST ESTIMATE
Total Gross Building Area:   s.f.
Total Site Acreage:          ac.
Total On-Site Parking Spaces:

(ITEM NUMBERS 1, 2, AND 3 BELOW INCLUDE GENERAL CONDITIONS, OVERHEAD, PROFIT AND BONDS.)

1. Building Cost

   a.  General Construction--Building excavation, foundation, structure, roofing, exterior and interior walls, doors, windows, finishes, specialties, and conveying equipment except as listed below $ xx,xxx.00

   b.  Plumbing--All building plumbing to five (5) feet outside of building line xx,xxx.00

   c.  Mechanical--All building HVAC, including heating and chilled water lines, to five (5) feet outside of building line xx,xxx.00

   d.  Electrical--All building electrical work to five (5) feet outside of building line xx,xxx.00

   e.  Total Building Cost $ xxx,xxx.00

2. Fixed Equipment Cost

   a.  Built-in lockers, food service, fixed seating, casework, fume hoods, etc. xxx,xxx.00

3. Site Development Cost
General Requirements

a. Demolition--All demolition; whether site, structures, mechanical, electrical or plumbing, excluding asbestos removal $ xxx,xxx.00

b. Site Development--All walks, drives, parking, grading, walls, steps, and site appurtenances from five (5) feet outside edge of building xxx,xxx.00

c. Landscaping--All trees, shrubs, sod, planting and irrigation xxx,xxx.00

d. Site Mechanical--All HVAC and plumbing lines from five (5) feet outside edge of building, including storm and sanitary sewer systems xxx,xxx.00

e. Site Electrical--All electrical work from five (5) feet outside edge of building and cost of transformers regardless of location xxx,xxx.00

f. Total Site Development $ xxx,xxx.00

4. ESTIMATED CONSTRUCTION CONTRACT AMOUNT (SUM OF 1, 2, AND 3, NOT TO EXCEED 90% OF LINE 6) x,xxx,xxx.00

5. Bid Contingency (CSP) xxx,xxx.00

6. AMOUNT AVAILABLE FOR CONSTRUCTION CONTRACT $ x,xxx,xxx.00

Building Unit Cost (ITEM 1.e "TOTAL BUILDING COST" DIVIDED BY TOTAL GROSS SQUARE FEET) .................. $xx.xx Cost/G.S.F.

Alternates (CSP ONLY - LIST BY NUMBER WITH BRIEF DESCRIPTION AND ESTIMATED COST)
General Requirements