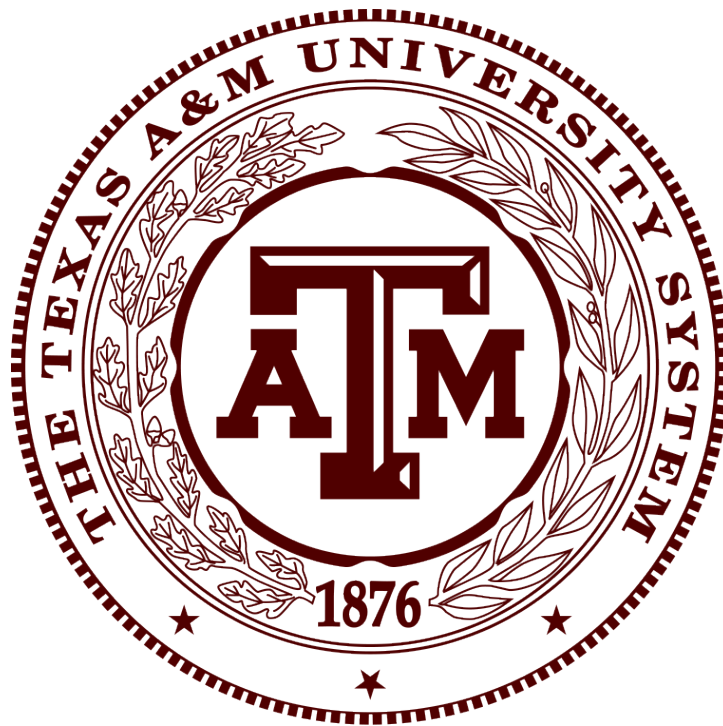


# Facility Design Guidelines



The Texas A&M University System  
Office of Facilities Planning and Construction  
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## Contents

	Page
Introduction	ii-1
Design Criteria	A-1
Design Requirements	B-1
Division 00 – Procurement & Contracting Requirements	00-1
Division 01 – General Requirements	01-1
Division 02 – Existing Conditions	02-1
Division 03 – Concrete	03-1
Division 04 – Masonry	04-1
Division 05 – Metals	05-1
Division 06 – Wood, Plastics and Composites	06-1
Division 07 – Thermal and Moisture Protection	07-1
Division 08 – Openings	08-1
Division 09 – Finishes	09-1
Division 10 – Specialties	10-1
Division 11 – Equipment	11-1
Division 12 – Furnishings	12-1
Division 13 – Special Construction	13-1
Division 14 – Conveying Equipment	14-1
Division 21 – Fire Suppression	21-1

	<b>Contents</b>
Division 22 – Plumbing	22-1
Division 23 – Heating, Ventilating and Air Conditioning	23-1
Division 25 – Integrated Automation – Not Used	
Division 26 – Electrical	26-1
Division 27 – Communications	27-1
Division 28 – Electronic Safety and Security	28-1
Division 31 – Earthwork	31-1
Division 32 – Exterior Improvements	32-1
Division 33 – Utilities	33-1

### 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. 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).

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 their documents other products and/or manufacturers that are equal.

### 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.

# Introduction

### 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 design 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. In addition, if specific criteria is required to be met for a project type, the A/E shall include this criteria in the code analysis.

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 in Brazos County. 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 and/or the AHJ 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

1. National Fire Protection Association National Fire Codes, with emphasis on NFPA 1 and NFPA 101 - latest edition adopted by State Fire Marshall, Life Safety Code (LSC) and including all referenced standards.
2. International Building Code - latest edition

### Architectural Design

1. NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals as applicable
2. Texas Department of Licensing and Regulation (TDLR)  
Elimination of Architectural Barriers Act, Article 9102, Texas Civil Statutes and Texas Accessibility Standards (TAS)  
Elevators and Escalators, Health & Safety Code chapter 754 and 16TAC § 74  
ASME 17.1, 17.2, 17.3 and 18.1  
Boilers, Health & Safety Code chapter 755 and 16TAC § 65  
ASME Boiler and Pressure Vessel Code
3. Americans with Disabilities Act, 28 CFR Part 35 Nondiscrimination on the Basis of Disability in State and Local Government Services, Final Rule, as published in the Federal Register Friday, July 26, 1991
4. Fair Housing Act accessibility requirements for housing units.

### Civil/Structural Design

1. ACI – 318, building code requirements for structural concrete
2. AISC, specification for the Design, Fabrication and Erection of Structural Steel; Manual of Steel Construction
3. ASCE 7, Minimum Design Loads for Buildings and Other Structures
4. Texas Department of Insurance requirements First Tier Coastal Counties wind load criteria
5. Texas Department of Licensing and Regulation (TDLR) Elimination of Architectural Barriers Texas Government Code, Chapter 469, Texas Accessibility Standards
6. FEMA 100 year and 500 year flood plain designation
7. TCEQ, 30 TAC, Chapter 217 Design Criteria for Domestic Waster Water System
8. TCEQ, 30 TAC, Chapter 290, Public Drinking Water
9. TCEQ TPDES, Stormwater Discharges Associated with Construction Activities, TXR150000
10. Applicable AWWA, ASTM, and ANSI standards.

### Mechanical and Plumbing Design

1. International Mechanical Code latest edition
2. International Plumbing Code latest edition
3. International Fuel Gas Code latest edition
4. International Energy Conservation Code latest adopted edition

### Electrical Design

1. National Electric Code latest edition
2. National Electrical Contractors Association Standards latest edition
3. Institute of Electrical and Electronic Engineers Standards latest edition

### Communications Design

1. TIA/EIA Standards

### Energy and Water Conservation Design

1. Energy Conservation Design Standard for New State Buildings (including major renovation projects), State Comptroller's Office, Government Code sec. 447.004 and 34 TAC § 19.32  
ASHRAE / IESNA 90.1 latest adopted Edition
2. International Energy Conservation Code (IECC) latest adopted edition

- (Residential/Apartments)
3. SECO Alternative Energy Evaluation Requirements
  4. SECO Water Efficiency Standards for State Buildings and Institutions of Higher Education Facilities – January 2021

## 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.

Typical Occupancy	Maximum Noise Criteria (NC)
<b>Apartment/Dorms</b>	
Individual rooms/suites	35
Meeting/Banquet rooms	35
Halls, corridors & lobbies	40
Service/support areas	45
<b>Offices</b>	
Executive	30
Conference Rooms	30
Private	35
Open plan areas	40
Business machine areas	45
Public circulation	45
<b>Research, Hospital and Clinics</b>	
Private rooms	30
Wards	35
Operating rooms	25
<b>Laboratories</b>	
Research & general	35
Teaching	30
Corridors	35
Public Areas	40
Lecture & classrooms	30

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.

### 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.

### 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.

### 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](http://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 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. standalone 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, power factor correction)
5. Alternate/redundant power systems (Central UPS, Emergency Generator)

## 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 (crawl space vs. voids, drilled piers vs. auger cast pilings)

## 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

<https://www.energy.gov/eere/femp/building-life-cycle-cost-programs>

User Friendly Life-Cycle Costing – A spreadsheet implementation of BLCC and available at [www.doe2.com](http://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**

	Institutional	Commercial	Apartments
Structural Foundation	80 yrs		
Slab on Grade Foundation		50 yrs	30 yrs
Subgrade Waterproofing/Drainage	40 yrs		
Building Structure	80 yrs	50 yrs	30 yrs
Exterior Walls	80 yrs	50 yrs	30 yrs
Exterior Windows	40 yrs	40 yrs	30 yrs
Exterior Doors	40 yrs	40 yrs	30 yrs
Roofing	20 yrs	20 yrs	20 yrs
Interior Partitions	20 yrs	15 yrs	15 yrs
Interior Doors	20 yrs	20 yrs	15 yrs
Interior Finishes	15 yrs	10 yrs	5 yrs
Elevators	25 yrs	20 yrs	20 yrs
Equipment	25 yrs	20 yrs	15 yrs
Furnishings	20 yrs	15 yrs	10 yrs
Plumbing Rough-in	80 yrs	50 yrs	30 yrs
Plumbing Fixtures	30 yrs	30 yrs	30 yrs
HVAC Boilers/Chillers	30 yrs	30 yrs	15 yrs
HVAC Equipment	20 yrs	20 yrs	15 yrs
HVAC Distribution	40 yrs	40 yrs	30 yrs
Fire Protection System	40 yrs	40 yrs	30 yrs
Fire Detection System	20 yrs	20 yrs	20 yrs
Electrical Medium Voltage Equipment	30 yrs	30 yrs	30 yrs
Electrical Duct Bank	80 yrs	80 yrs	80 yrs
Low Voltage Electrical Rough-in	80 yrs	50 yrs	30 yrs
Low Voltage Electrical Equipment	30 yrs	30 yrs	30 yrs
Lighting	30 yrs	30 yrs	20 yrs
Communications	20 yrs	20 yrs	15 yrs

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.

Additional information can be found in the THECB webpage:

<https://reportcenter.highered.texas.gov/agency-publication/guidelines-manuals/cbm-appendices-to-the-reporting-and-procedures-manuals-spring-2022/>

### 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 overhead 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. Include emergency lighting and adequate infrastructure for onsite maintenance. 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 Rooms and Closets**

Electrical rooms and 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, do not route above electrical equipment. Provide a least one room per floor. 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. The rooms shall have a 2 hour firewall rating and shall not be sprinkled per NFPA 13 allowance. 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 provide unhindered egress.

### **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.

Coordinate room numbers with System Member during design utilizing their latest available guidelines. Obtain approval at the Design Development phase.

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

Refer to the System Member for guidelines for numbering of all un-assignable spaces such as corridors, vestibules, stairs, restrooms, elevators, building services, etc. Rooms that have no internal access are not numbered from an interior corridor.

### Campus Specific Information

#### Texas A&M University

#### Design Review

All projects shall be submitted for alignment with the design principles in the campus master plan. The final report of the 2017 master plan can be found at the following link: [Campus Master Plan - Texas A&M University Division of Finance and Operations \(tamu.edu\)](https://campusmasterplan.tamu.edu/)

#### 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 buildings 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 ¾" 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 buildings 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

Throughout the design and construction process, the design and construction teams are required to utilize owner's project management information systems e-Builder and Autodesk Build/BIM360 Build (Build). Both of these systems are "cloud based" and can be accessed using most internet browsers. Throughout this document, whenever PMIS is used, it is referring to both e-Builder and Build. Otherwise, the names e-Builder and Build will be used in conjunction with tasks specific to that platform.

The following identifies those activities that occur in the two systems. This is subject to change on each project. Training for both systems is available and should be scheduled through the FPC Project Manager.

## E-Builder

All payment applications, change requests, reimbursable expense approvals and changes to the original submitted HUB subcontracting plan will be submitted and routed for approval through e-Builder. Other items in e-Builder are documentation concerning 811 utility locates, utility outage requests, PMIS login request, contractor daily log, substantial completion, requests for information, architects supplemental instructions, submittals, substitution requests and contractor buy out documentation (CMAR and DB only). On competitive sealed proposal projects, bids will be received through e-Builder.

All payment applications shall be accompanied by a completed Progress Assessment Report (PAR). Payments can only be processed if the required insurance certificates have not expired. If the payment request includes a reimbursable expense, then backup documents is also required. At different stages in a project there may be additional project documentation required as part of a payment application.

The design and construction agreements contain several items that are reimbursable services. Even though these items are listed in the agreement they still need to be authorized by the Owner prior to execution of the services. This authorization request is through an e-Builder process and will include a proposal for the services with a not to exceed amount from the consultant/vendor.

If at any time during the course of a project the design or construction team need to add and/or modify a consultant/subcontractor the firm is required to submit a modified HUB Plan to the Owner. This can be accomplished through an e-Builder process.

## Autodesk Build/BIM360 Build

All drawings, specifications and supporting documentation will be uploaded to Build. During construction, Build will serve as the location for the contractor's record set of documents. Other items in Build are meeting minutes, design coordination clash detection, quality control checklists and punch lists.

## Collaborative 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 building information models (models), 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.

## Correspondence and Reports

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.

Communications between all parties involved in the planning and construction of a project is a requisite. All meeting minutes shall be entered into Build using the meeting minutes process. Emails can be uploaded or emailed to the e-Builder folder 03.11 Emails.

## 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 the drawings required for Design Development submittal. The A/E is encouraged to use BIM to verify compliance with the POR. 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-Nnn

Where "A" is the discipline designator, "N" is the drawing sheet type designator, and "nn" is the sheet number.

The following are the discipline designators as well as the order the drawings should be placed in a set.



## Design Requirements

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 typical drawing sheet type designators.

0	-	General
1	-	Plans
2	-	Elevations
3	-	Sections
4	-	Large Scale Views
5	-	Details
6	-	Schedules and Diagrams
7	-	User Defined
8	-	User Defined
9	-	3D Representations

Sheet 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. Drawing orientation should be either north to the top or right of the sheet.

The title block shall include at a minimum, beginning from bottom of title block to top:

- Sheet number
- Sheet Title
- A&M System Project Number
- Building Inventory Number (supplied by system member)
- Drawn by
- Checked by
- Name of Project
- Campus or Agency
- Location
- Firm name of Architect/Engineer under contract with owner and consultant if

## Design Requirements

- 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(s) shall contain

- Location Map showing contractor's route, construction limits and contractor lay down area
- Index of drawings
- Abbreviations used in the project
- 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 appear by each equipment and 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 shall 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.

A KML or KMZ file at the close out of the project showing outlines of new buildings, site improvements, flat work and utilities.

The A/E is to set the project origin. This origin shall be the same for all models. The origin

## Design Requirements

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.

All consultants shall produce BIM models or 3D CADD.

The survey of the project shall also be produced using BIM authoring software or 3D CADD. 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.

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:

- Location, that is room number in which or above which the piece of equipment is located.
- 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.
- 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.
- 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.

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 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 models should be used to generate quick images for use in explaining the spaces to the clients. Elaborate renderings are not always required.

## Design Requirements

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. Each piece of equipment on schedule should include estimated quantity and multiple acceptable manufactures. 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, load summary and all panel Nameplate data. 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:

xpn

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 one line diagram shall show in a one line format all medium voltage equipment including manholes, switchgear, transformers and cables. The Low Voltage system (600 volt and below) shall be detailed to the branch circuit panelboard level and to any point required in the NFPA 70E to have an Arch Flash Label. Online shall include all information that results from an electrical study, such as: 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 2012 and be prepared in letter format.

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 Managers 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 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).

## Design Requirements

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 of PROJECT MANUAL."
- Name of Project.
- Name of University or Agency.
- Location of Project.
- Project Number (including Federal project number, if applicable)
- Owner: "The Texas A&M University System."
- Firm name of A/E.
- Issue Date

The Board of Regents title page in the specifications shall contain the following information

- Name of Project.
- Name of Part of System applicable.
- Location of project.
- Project Number (including Federal project number, if applicable).
- Members of the Board of Regents, The Texas A&M University System.
- Chancellor, The Texas A&M University System.
- President or Director of the University or Agency of the System.
- Deputy Chancellor & Chief Financial Officer
- Vice Chancellor for Business Affairs
- Chief Facilities Officer.
- Director

The typical order of documents for the specifications is as follows:

01. Cover
02. Board of Regents Title Page
03. Design Team Professional Seals Page(s)
04. Table of Contents
05. Schedule of Drawings
06. Instructions for Competitive Sealed Proposals (CSP Delivery Only)
07. Supplemental Instructions for Competitive Sealed Proposals (CSP Delivery Only)
08. Bid/Proposal Bond (CSP Delivery Only)
09. Part 1. Certification (CSP Delivery Only)
10. Part 2. Proposer's Qualifications (CSP Delivery Only)
11. Part 3. HUB Subcontracting Plan (CSP Delivery Only)
12. Agreement – Form C-5 (CSP Delivery Only)
13. Guaranteed Maximum Price (GMP) Proposal (CMAR & DB Delivery Only)
14. Performance Bond
15. Payment Bond

- 16 Uniform General Conditions
- 17 Special Conditions
- 18 Prevailing Wage Rate Schedule
- 19 Geotechnical Investigation Report
- 20 Divisions 1 through 33 (as needed)

### Square Foot Tracking

The Project A/E is required to track the net and gross square footage of their design from the Program of Requirement through all design milestones and ending with final completion of construction. At each design milestone, the Project A/E must complete the area summary spreadsheet and upload it as part of an e-Builder process.

The Project A/E is required at the Design Development milestone to create floor plans that illustrate by color net assignable square foot, education & general net assignable square foot and unassignable square foot based on guideline from the State Higher Education Coordinating Board. To complete these floor plans follow the instructions located in e-Builder document folder 07.02 Sketches-Views.

The Project A/E is required to complete and provide to the FPC Project Manager the Autodesk Build location template to be imported to Autodesk Build. The template spreadsheet is located in e-Builder folder 08.02 Sketches-Views.

### Schematic Design

#### Interim Schematic Design Meetings.

Establish interim schematic design meetings as required prior to the final schematic design submission and review. Materials submitted and reviewed during these meetings along with meeting minutes shall be uploaded to Owner's Build site.

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 in PMIS 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

All documents included within the submission shall be uploaded to Owner's Autodesk Build site according to instructions provided during training.

### 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

- Civil notes.
- Civil site plan(s) at the same scale and orientation as the architectural site plan showing existing and new vehicular and pedestrian flat work, and existing and new utilities including site mechanical, electrical and telecommunications.
- Site plan showing the limits of construction and construction staging area showing construction fences, gates, trailers, and traffic flow.
- Site demolition plan showing all site demolition
- Grading plan showing existing and new contours and key elevations.
- Storm plan showing site drainage areas maps for pre and post construction and calculations of runoff.



# Design Requirements

## 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.
- Preliminary schedules for beams, columns, joists, piers/piles, etc.

## 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.
- Space assignment floor plans indicating net assignable space as E&G and non-E&G, and unassignable space by different colors and hatching. Drawings to coordinate with (and be filed with) Space Summary in Basis of Design Reports. Net Assignable and Unassignable totals shall be given per floor, with the total summed space indicated on the First Floor Plan sheet.

## Equipment

- Floor plan of typical laboratories showing laboratory casework and laboratory equipment.

## Plumbing

# Design Requirements

- 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

All reports shall also be uploaded to Owner's Build in PDF 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

## Design Requirements

- 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 total by net assignable E&G, net assignable non-E&G, unassignable, and gross, with efficiency of net to gross calculated.
- List of all variations from the Program of Requirements, Facility Design Guidelines, and Campus Master Plan that have been included in the Schematic Design.
- Life Cycle Cost Analysis for three or more major building systems and the determination of the system to move forward with in each case.

### Cost Estimate

- Cost estimate in MasterFormat 2012 format.

### Review Process

A minimum of two weeks prior to the first submission of schematic design documents, the A/E shall request Build training from the FPC Project Manager.

The schematic design documents shall be uploaded to Owner's Build site per training. These documents shall be reviewed in Build and comments marked as Issues for the design team.

### 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 cost estimator or contractor in a Construction Manager at Risk or Design-Build project.
- 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.

### Interim Design Development Progress Meetings.

Review the recently closed issues from Schematic Design. Comments/issues noted in FPC's PMIS shall be incorporated into the documents prior to closing the issue. In order for a comment to be closed, comment must be visually reviewed with an updated document.

Results of these meetings must be documented in a narrative describing systems and identifying the scope that will be in the project. Meeting agendas and minutes maintained within Build.

All documents included within the interim submissions shall be uploaded to Owner's Build site according to instructions provided during training.

All submitted documents shall be complete and coordinated between design disciplines.

All documents will address all comments from Schematic Design phase.

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.

### Design Development Clash Detection/Coordination

At a minimum, during 50% DD phase or as agreed to by FPC, upload models into Build for clash detection review in accordance with the BIM execution plan. Comments/issues noted in Build will be used to assist with the review process, as needed. In order for a comment to be closed, a comment must be visually reviewed with an updated document.

We acknowledge that early in the design phase there will be clashes that will be resolved during the course of the design. Critical clashes may result in an issue being created.

## Minimum Requirements for Design Development Submittal

(Includes requirements for Schematic Design Submittal)

All documents included within the submission shall be uploaded to Owner's Build site according to instructions provided during training.

### 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

- Separate site fire plan
- Separate dimension plan with survey control information.
- Separate plans showing new paving with jointing and dimensions.
- Separate composite utility map including site mechanical, electrical and telecommunications.
- Separate individual utility plan sheets and profile sheets for all proposed underground utilities including any conduit, pipe, duct 2" and larger, excluding irrigation, sleeves, and lighting services. Full drainage plan and maps with calculations, including detention.
- Erosion control plans, details, and plan narrative.
- 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.

# Design Requirements

## 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.
- All 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.
- Space assignment floor plans indicating net assignable space as E&G and non-E&G, and unassignable space by different colors and hatching. Drawings to coordinate with (and be filed with) Space Summary in Basis of Design Reports. Net Assignable and Unassignable totals shall be given per floor, with the total summed space indicated on the First Floor Plan sheet.

## Equipment

- Floor plan of all laboratories showing laboratory casework and laboratory equipment.

# Design Requirements

- 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

## Design Requirements

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 and total by net assignable E&G, net assignable non-E&G, unassignable, and gross, with efficiency of net to gross calculated.
- Code Analysis
  - Life Safety Code Analysis: Provide a code analysis of the design utilizing the Life Safety Code, latest edition (NFPA 101) and all referenced codes.
  - Building Code Analysis: Provide a code analysis of the design utilizing the International Building Code, latest edition covering only those elements not covered by the Life Safety Code (no duplicate items).
- Preliminary Drainage Report
  - Provide a report detailing methodology; pre and post construction runoff calculations; flood plain information; drainage area maps; hydrological and hydraulic computations for inlets, drains, pipes, and structures, hydrographs, and storm profiles showing water surface and hydraulic grade line (HGL) elevations.
- 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



## Design Requirements

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.
- List of all variations from the Program of Requirements, Facility Design Guidelines, and Campus Master Plan that have been included in the Design Development documents.

### 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.

### Review Process

The Design Development documents to be reviewed will need to be uploaded into the appropriate folder within Build. The documents will be packaged as a set and sent to the project team for review. The project team will provide comments/issues within the documents utilizing an issue feature within Build. The design team is responsible for ensuring issues are sent to the appropriate consultant, answered completely, and sent back to the creator. Issues noted in Build shall be incorporated into the documents prior to closing the issue. In order for a comment to be closed, comment must be visually reviewed with an updated document.

### 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 acceptable.

Upon completion of Design Development, the following are established such that the

## Design Requirements

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 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".
- When construction approval is required based on the project schedule, a PowerPoint presentation will be used by FPC to present the project to the Board of Regents. For this presentation, the A/E will coordinate with FPC to provide images that include campus plan, site plan, representative floor plan(s) and exterior perspective(s).

### Construction Documents

The approved Design Development documents shall be developed into Construction Documents sufficient to construct the project.

### Interim Construction Documents\_Progress Meetings

All documents included within the submission shall be uploaded to Owner's Build site according to instructions provided during training.

## Design Requirements

Review of outstanding and recently closed issues from previous phases. Comments/issues noted in Build shall be incorporated into the documents prior to closing the issue. In order for a comment to be closed, comment must be visually reviewed with an updated document

Results of these meetings must be documented in a narrative describing systems and identifying the scope that will be in the project. Meeting agendas and meetings minutes shall be maintained within Build.

All submitted documents shall be complete and coordinated between design disciplines throughout the project.

All documents will address all the comments made from the previous design phases.

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.

### **Construction Documents Clash Detection/Coordination**

Continue Clash Detection from the DD phase. Upload models into Build for clash detection and review in accordance with the BIM execution plan. Comments/issues noted in Build will be used to assist with the review process. In order for a comment to be closed, a comment must be visually reviewed with an updated document.

Critical clashes may result in an issue being created. Prior to issuing documents, all previously discussed clashes shall be resolved.

- Clash and collision detection report summary. The report submitted should have been evaluated so that only legitimate clashes remain for review. The A/E is

responsible for generating this report in the absence of a Construction Manager. When a Construction Manager is part of the design phases they shall be responsible for running and vetting the report.

## Minimum Requirements for Construction Document Submittal

(Includes requirements for Design Document Submittal)

All documents included within the submission shall be uploaded to Owner's Build site according to instructions provided during training.

## 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
  - Life Safety Code Analysis: Provide a code analysis of the design utilizing the Life Safety Code, latest edition (NFPA 101) and all referenced codes.
  - Building Code Analysis: Provide a code analysis of the design utilizing the International Building Code, latest edition covering only those elements not covered by the Life Safety Code (no duplicate items).
- Final Drainage Report
  - Provide a final report, signed and sealed by a Professional Engineer in the State of Texas, detailing methodology; pre and post construction runoff calculations; flood plain information; drainage area maps; hydrological and hydraulic computations for inlets, drains, pipes, and structures, hydrographs, and storm profiles showing water surface and hydraulic grade line (HGL) elevations.
- Energy Conservation
  - Provide a report on energy conservation provisions at Design Development that

## Design Requirements

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 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 summary.
- List of all variations from the Program of Requirements, Facility Design Guidelines, and Campus Master Plan that have been included in the Construction Documents

### 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.

## Review Process

The Construction Documents to be reviewed will need to be uploaded into the appropriate folder within Build. The documents will be packaged as a set and sent to the project team for review. The project team will provide comments/issues within the documents utilizing an issue feature within Build. The A/E is responsible for ensuring issues are sent to the appropriate consultant, answered completely, and sent back to the creator. Issues noted in Build shall be incorporated into the documents prior to closing the issue. In order for a comment to be closed, comment must be visually reviewed with an updated document.

## 100% Construction Documents Review

Drawings for all divisions of work shall be complete and thorough in all respects, 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% Construction Documents 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. Comments/issues noted in Build shall be incorporated into the documents prior to closing the issue. In order for a comment to be closed, comment must be visually reviewed with an updated document.

## Bidding and Contract Award Stage (CSP Only)

The FPC Project Manager will establish the dates for advertising, pre-proposal

## Design Requirements

conference, and proposal opening in consultation with the Project A/E for projects that utilize the Competitive Sealed Proposal process to procure a Contractor

All bids shall be received through the e-Builder bidding portal.

If addenda are required, they will be issued through the e-Builder bidding portal

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.

After the proposal opening the Project A/E will be provided access to the Part 2 General Contractor Qualifications submittals.

The Project A/E will assist in analyzing bid proposals, and provide reports as required concerning the experience, qualifications and references of the bidders.

The Project A/E is required to attend the contractor evaluation meeting.

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.

### **A/E Bid Analysis (CSP 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 consideration in taking action on the bids. The analysis shall be a concise evaluation of the low bidder and 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 latest 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 Owner 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.

### 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 answer 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.

### Shop Drawings and Submittals

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 Conditions included in the Design Criteria section of this manual.

### 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. 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 acceptance or rejection of contractor substitution request. Concurrence from FPC Project Manager is required prior to the approval of any substitution request. All substitution request shall be submitted through e-Builder by the contractor.

## **A/E Final Drawings**

The Project A/E is required to provide final models, drawings and specifications that reflect all changed made by the Project A/E during construction. These documents shall be uploaded to e-Builder subfolders under 11 AE Closeout. Final models shall be upgraded to the latest software version in use by the Project A/E and uploaded in both native file format and IFC file format. Final drawings shall be uploaded as individual sheets in both PDF and DWG file formats. The DWG files shall have all reference files attached. Specifications shall be uploaded by section in PDF format.

Models shall be named with the discipline (Arch, Elec, Mech, etc), the software version number and file extension.

Both PDF and DWG files shall be named with the sheet number and sheet name then file extension.

Specifications shall be named by section number and section name then file extension.

Do not include project numbers or project name in the file name.

## **Specific Campus Requirements**

### **Texas A&M Health Science Center**

#### **Building Information Modeling (BIM) & Facilities Management (FM) Data Requirements**

Refer to the Health Science Center facilities representative for the current BIM and facilities maintenance data requirements.

# Design Requirements

## Division 00 – Procurement and Contracting Requirements

### 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 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 Conditions, Form C-8

## Division 00 – Procurement and Contracting Requirements

Special Conditions and Wage Rates  
Soil Investigation Data

### General Information

The following Division 1 Sections have been developed to work with the Uniform General 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
- 01 25 00 - Substitution Procedures
- 01 26 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 - Facilities Management Data Specification
- 01 80 00 - Excavating Near Existing Utilities

## Division 01 – General Requirements

### 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. Where determined a value add to the project, a Subsurface Utility Engineering (SUE) survey shall be conducted by the Owner and provided to the A/E team.

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/3D CADD authoring program. 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', or best scale that shows site details, and the title block shall include the project name and project number. The final survey shall be sealed by a Texas RPLS. Upon completion of the survey upload a PDF of the survey to the 06.03 SD PDFs & Specs folder and the native DWG file and ASCII file of all point elevations and survey control to the 06.04 SD DWGs folder in e-Builder.

#### **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.

## Division 02 – Existing Conditions

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.

## Division 02 – Existing Conditions

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. A crawl space with a structural foundation is required for all institutional facilities. (Ref: FDG Division 3 Concrete). For other classifications (commercial,

## Division 02 – Existing Conditions

etc.), an analysis shall be performed for selection of the foundation system.

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 and campus specific requirements.

## 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 or The System Member Facilities Department. 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 be 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 buildings shall be determined by the International Building Code. However, in all cases shall include a minimum of 100 psf.

Design team shall work with The System Member to determine if concentrated loads and/or vibration requirements will be required.

### Porches and Steps

All stoops, porches, ramps, docks and steps, exterior and interior should have non-slip surfaces and nosing's where applicable. Slope exterior porches and treads where allowed by Texas Accessibility Standards to drain water. Ponding of water in these areas is unacceptable. It is recommended that exposed concrete work be accomplished in two pours: the first structural and the second a finish topping pour. Other option is protecting the work during construction.

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

A walkable crawl space is required under all institutional building types. 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 System

Member. 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 a concrete compatible with the roof systems used on the campus.

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 doveled to the building foundation at all door locations. At all other locations the mow strip shall not be doveled to the building foundation unless approved otherwise by the System Member Facilities Department

Include a mow strips along and doveled 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 generally shall be ASTM C216; Type FBS grade SW unless indicated otherwise in POR or by The System Member Facilities Department.

In the drawings the A/E will provide a detail that indicates the size of mock-up panel that will contain all exterior materials such as brick, stone, cast stone, curtain wall, glazing, frames, waterproofing, sealants, etc. for final approval of all exterior colors for the project as well as assembly means and methods. The material colors will be approved by The System Member.

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 Executive Director 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 comply with ASTM C90.

### 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 should 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**

As a part of Schematic Design, the A/E shall recommend to the Owner a brick blend for the building that is compatible with the surrounding buildings. FPC has brick panels that match the blend of several buildings on campus that can be used by the A/E to develop the recommendation.

The Owner will provide a conditional approval contingent upon reviewing a brick panel at the jobsite. Owner's approval of the brick panel shall be received prior to the Contractor's ordering brick.

#### **Cut Stone & Cast Stone**

As a part of Schematic Design, the A/E shall recommend to the Owner color for cut and/or cast stone for the building that is compatible with the surrounding buildings.

The Owner will provide a conditional approval contingent upon reviewing the cut and/or cast stone incorporated into the brick panel at the jobsite. Owner's approval of the panel shall be received prior to the Contractor's ordering cut and/or cast stone.

## **Tarleton State University**

### **Brick**

Verify brick blend during Schematic Design with campus. The following has been utilized on prior projects.

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**

Verify brick blend during Schematic Design with campus. The following has been utilized on prior projects.

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**

Verify brick blend during Schematic Design with campus. The following has been utilized on prior projects.

Acme Brick: PEP Blend No. 30 – Dove Grey

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

### **Brick**

Verify brick blend during Schematic Design with campus. The following has been utilized on prior projects.

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**

Verify brick blend during Schematic Design with campus. The following has been utilized on prior projects.

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 Valdars Stone and Marble, Inc., Valdars, Wisconsin.

## **Texas A&M University-Kingsville**

### **Brick**

Verify brick blend during Schematic Design with campus. The following has been utilized on prior projects.

Acme Brick ELP Blend No. 154 Sierra

Acme Brick ELP Blend No. 102 Yellow/Tan Martini

## **West Texas A&M University**

### **Brick**

Verify brick blend during Schematic Design with campus. The following has been utilized on prior projects.

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**

Verify brick blend during Schematic Design with campus. The following has been utilized on prior projects.

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



## General Information

### General

Wherever possible the A/E shall, in accordance with Tx. Govt. Code Chapter 2252 specify iron and steel products that are produced in the United States. The A/E shall notify the Owner of any specified iron and steel product not produced in the United States. The A/E shall also advise the Owner if any of the exemptions identified in Chapter 2252 such as availability and quality might apply.

Pursuant to Sections 2252.201-2252.205 of the Government Code, Contractor shall require that any iron or steel product produced through a manufacturing process and used in the Project be produced in the United States. Contractor will require that the bid documents provided to all bidders and the contract include this same requirement.

### 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, where required by the System Member Facilities Department, is designed to prevent galvanic corrosion between dissimilar metals. Do not use a combination of materials that form 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 Forest Stewardship Council (FSC) Certified Wood or regionally available from abundant sources. Avoid the 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 American Wood Protection Association (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

Exterior wall construction with brick and metal stud back-up sheathing material shall be Dens-Glass 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.

## Division 6 – Wood, Plastics and Composites

### General Information

Building Envelope shall comply with State Energy Code adopted at end of Schematic Design.

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 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.

### Roofing

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 fascia where roof drains are used.

Provide drips on overhangs, ledges, window stools and coping to prevent discolorations of fascia, 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).

## Division 07 – Thermal and Moisture Protection

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.

### Campus Specific Information

#### Texas A&M University

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 may also be specified, but should only be specified for low-traffic roofs with few penetrations and very little rooftop equipment. 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 and may require appropriate screening as determined by the Facilities Department.

#### Texas A&M University at Galveston

Single Ply designed to comply with Texas Windstorm requirements.

#### Tarleton State University

Single Ply – Sarnafil PVC

Classification: Type II, Grade I, PVC

## Division 07 – Thermal and Moisture Protection

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 or modified bitumen roof assembly shall be designed to comply with Texas Windstorm requirements.

### **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

## Division 07 – Thermal and Moisture Protection

### 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.

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 County 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 closers 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 oil impregnated 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.

For doors with heights up to 60 inches provide two hinges. For doors with heights 61 to 90 inches provide three hinges. For doors with heights 91 to 120 inches provide four hinges

### **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

Project A/E shall refer to Architectural & Landscape Design Standards located at [design-standards-architectural-landscape.pdf \(tamu.edu\)](https://www.tamu.edu/design-standards-architectural-landscape.pdf)

### RELLIS Campus

Project A/E shall refer to Facilities Design Guidelines located at [Facilities Design Guidelines - The RELIS Campus \(tamus.edu\)](https://www.tamus.edu/facilities-design-guidelines-the-rellis-campus)

### 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  
1/4" bronze tempered glass (exterior)  
1/4" clear tempered glass (interior)  
SL-484 12" FPR Mid-panel  
SL-88 recessed pull  
10" bottom

#### Hardware

##### Hinges

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.

Standard: ANSI A156.4, Series 2000.

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.

Cabinets – Olympus Lock, Inc. Pin Tumbler Cabinet Door & Drawer Lock 700 LCA on drawer and one door if double door cabinet. Secondary cabinet door shall have Amerock E.Z. Flex Elbow Catch.

### **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.

Panic hardware with battery alarm to be standard unit of manufacturers and series noted above.

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 or 4040XP



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 shall be 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

Lockset – Heavy duty mortise lockset with cast lever and rose trim. Finish: US32D satin stainless steel at exterior openings; US26D satin chrome plated at interior openings. Provide Best interchangeable cores, MX8 patented keying system.

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:

*UNOBSTRUCTED:* 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 ft<sup>3</sup> (2.8 m<sup>3</sup>), 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 under the painting section of the specifications.

## Division 09 – Finishes

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

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

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.

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

## Campus Specific Information

### 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

### Painting Standards

Standard White – Standard white shall be Kelly-Moore Egg Shell Dura-Poxy Latex (1605-100) mixed with 1/8 oz. Raw Umber or 00-0257. This product is to be used in all dorm rooms or as directed by the WTAMU Painting Manager.

WT Off-White – WT Off-white shall be Kelly-Moore Dura-Poxy Egg Shell Latex. Mix on record at Amarillo, Texas Kelly Moore Dealer

Old Main White – Old Main White shall be Kelly-Moore Dura-Poxy Egg Shell Acrylic Enamel (1685-111). This product is to be used in all Old Main trim work or as directed by the WTAMU Painting Manager.

Old Main Flat White – Old Main flat white shall be Kelly-Moore Interior Flat Latex Wall Paint (550- 121). This product is to be used in the lobby area and some ceiling trim in Old Main or as directed by the WTAMU Painting Manager.

Old Main Flat Grey – Old Main Grey shall be Kelly-Moore Interior Flat Latex (551-121) mixed to 97-1229 color. This product is to be used in Old Main or as directed by the WTAMU Painting Manager.

Old Main Grey Dura-Poxy - Old Main Grey Dura-Poxy shall be Kelly-Moore Egg Shell Dura-Poxy Enamel (1685 Old Main Grey at Amarillo, Texas Kelly-Moore Dealer). This product is to be used below the wainscoting in Old Main hallways or as directed by the WTAMU Painting Manager.

University Maroon: PMS 7421C CMYK values from Illustrator: 38, 94, 63, 45 and RGB values: 106, 26, 49 (Revised 9/5/2015)

Blue – Kelly-Moore Caribbean Sky Dura-Poxy Egg Shell Latex, KM-3178-1

Green - Kelly-Moore Spring Frolic Dura-Poxy Egg Shell Latex, KM-3402-1

Yellow - Kelly-Moore Shredded Wheat Dura-Poxy Egg Shell Latex, KM-3530-1

Maroon – Rust Oleum Industrial Acrylic 5205 or 5207 Metal Trim or Kelly-Moore

## Division 09 – Finishes

Sequoia Redwood Dura-Poxy Egg Shell Latex.

Metal Paint - Kelly-Moore DTM (Direct to Metal)

Campus Standard vendor is Kelly-Moore.

Paint Standards	Egg Shell Finish Standard Brand (for color card reference only if not Kelly more)		
	Color Name	Number	KM Color #
Benjamin Moore	Muslin	OC-12	10-605
Benjamin Moore	Providence Blue	1636	10-613
Sherwin Williams	Porpoise	SW 7047	10-610
Sherwin Williams	Golden Gate	SW 7679	10-611
Benjamin Moore	Crownsville Gray	HC-106	10-609
Benjamin Moore	Brewster Gray	HC-162	10-608
Benjamin Moore	Huntington Beige	HC-21	10-607
Kelly Moore	Bravado	160	160
Sherwin Williams	Peace Yellow	SW 2857	KM3492-2
Sherwin Williams	Roycroft Copper Red	SW 2839	10-612
Sherwin Williams	Leisure Blue	SW 6515	09-138
Sherwin Williams	Clary Sage	SW 6178	08-130
Sherwin Williams	Cajun Red	SW 0008	
Sherwin Williams	Realist Beige	SW6078	
PPG	Wheat Sheaf	415-3	
Benjamin Moore	Antique Pewter	1560	10-621
Benjamin Moore	Rhine River	689	10-632
Benjamin Moore	Ashen Tan	996	10-631
Benjamin Moore	Gold Finch	187	10-633
Benjamin Moore	Newburyport Blue	HC-155	10-730
ICI	Pacific Pines	911	10-729
Benjamin Moore	Brookline Beige	HC-47	10-620
Benjamin Moore	Amethyst Shadow	1441	10-797
Benjamin Moore	Classic Burgundy (Ready Mix)	(RM)E-26	
Sherwin Williams	Artisan Tan	SW 7540	10-245
Sherwin Williams	Stone Lion	SW 7507	10-249
Sherwin Williams	Zeus	SW 7744	10-246
Sherwin Williams	Steely Gray	SW 7664	10-247
Kelly Moore	Lovely Lace		OW255-1
ICI	Ivory Silk	2007	OW240-1
ICI	Grey Squirrel	166	10-681
Benjamin Moore	York Harbor Yellow	2154-40	10-680
PPG	Dusty Yellow	214-3	10-682-1402
Benjamin Moore	Vanilla Ice Cream	2154-70	10-678-1402
Benjamin Moore	Blue ridge Mountains	1043	
Benjamin Moore	Classic Burgundy	E-26	
Sherwin Williams	Bittersweet Stem	SW 7536	
Sherwin Williams	Hopsack	SW 6109	
Benjamin Moore	Deer Path	1047	
Benjamin Moore	Crownsville Gray	HC-106	10-609



Kelly Moore	Bashful Emu	KM4908	KM4908
Kelly Moore	Zinc Dust	KM4903	KM4903
Sherwin Williams	Tree Branch	SW 7525(288-C7)	
Sherwin Williams	Decorous Amber	SW 0007	
Sherwin Williams	Dormer Brown	SW 7521(288-C5)	

## Ceiling Tile & “T” Grid Standards

All ceiling tiles shall have minimum 4” batt insulation above.

Standard Tile (non-regular) – 2’ x 4’ x 5/8” Armstrong 769A Tile in White “T” Grid.

Acoustical Sensitive Areas (non-regular) – 2’ x 2’ x 1” and 2’ x 4’ x 1” Armstrong 3152 Tile in White “T” Grid.

Kitchen Tile – 2’ x 4’ x 5/8” Armstrong BP870A Nonperf Clean Room VL FireGuard HumiGard Plus Tile in White Aluminum “T” Grid.

Wet Areas (i.e. Cafeteria Drink Room, Residence Hall Restrooms) – 2’ x 4’ x 1/2” Gridstone Brand Fire-Shield Gypsum Ceiling Panels, National Gypsum Company

Grid shall be 15/16” exposed Tee type – Armstrong preferred. In wet or kitchen areas use stainless grid with white face finish.

## Floor Covering Standard

Vinyl Composition Floor Tile Colors  
Field – Armstrong 51911 Classic White  
Accents – Armstrong 51814 Pomegranate Red

Carpet  
Tile and Plank Styles / Brand to be presented for review.

Vinyl Plank  
Plank Styles / Brand to be presented for review.

## Attic Stock Summary

Tile (Ceramic):  
The Contractor shall furnish the owner an additional 10% of the total project not to exceed four (4) full boxes of the same tile installed.  
Boxes shall be labeled with:

1. Brand and color name and identifying number.
2. Location installed (building for large project, building and room for small projects).
3. Date installed.

4. General Contractor and Sub-contractor name.

### Acoustical Ceiling Tile:

The Contractor shall furnish the owner an additional 10% of the total project not to exceed two (2) full boxes/bundles of the same tile installed if not campus standard.

Boxes/bundles shall be labeled with:

1. Brand and color name and identifying number.
2. Location installed (building for large project, building and room for small projects).
3. Date installed.
4. General Contractor and Sub-contractor name.

### Resilient Flooring (Tile, base and stair covering):

The Contractor shall furnish the owner an additional 10% of the total project not to exceed two (2) full boxes of the same product installed if not campus standard.

Boxes shall be labeled with:

1. Brand and color name and identifying number.
2. Location installed (building for large project, building and room for small projects).
3. Date installed.
4. General Contractor and Sub-contractor name.

### Carpet:

The Contractor shall furnish the owner an additional 10% of the total project not to exceed ten (10) yards of the same carpet installed.

Broadloom carpet shall be provided in one piece, 12-foot wide and shall be wrapped in plastic, labeled, and stored in an area designated by the owner.

Tile carpeting shall be furnished in full boxes, labeled, and stored in an area designated by the owner. The minimum amount of information the label shall contain is:

1. Broadloom only, amount of additional carpet supplied.
2. Brand and color name and identifying number.
3. Location carpet installed (building for large project, building and room for small projects).
4. Date installed.
5. General Contractor and Sub-contractor name.

### Paint and Coatings:

The Contractor shall furnish the owner two (2) new gallons of each finish coat of each “tinted to color” product except Dryfall.

Gallons shall be labeled with:

1. Brand and color name and identifying number.
2. Location applied (building for large project, building and room for small projects).
3. Date applied.
4. General Contractor and Sub-contractor name.

**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:  $\geq 0.117$  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 D 3936 delaminating of secondary back, Test ASTM D 1667 with 25% deflection @710 PSI.

10. Density: 4500 minimum.
11. Electrostatic Propensity: 3.5 KV or Less.
12. Warranty: Lifetime – 20 years, non-prorated warranty against delaminating, edge ravel, zipping, moisture penetration, wear.

C. Performance Characteristics:

1. Flammability:
  - a. Radiant Panel Test (Direct Glue): ASTM E-648, Class 1.
  - b. Pill Test: pass Doc FF1-70.
  - c. Flaming Mode: <450 per ASTM E-662 NBS Smoke Density.
  - d. Non-flaming Mode: <450 per ASTM E-662 NBS Smoke Density.
2. Static: < 3.5 KV Permanent Conductive Fiber per AATCC-134.
3. Electric Resistance: pass NFPA 99.
4. Burroughs Method: pass NFPA 99.
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.
  - 2. Recycling – turning waste materials into new materials.
- 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 shown at the end of this section shall be provided by Owner for installation by the contractor. During design the Project A/E in conjunction with the Owner shall identify a location for the plaque. Approximate weight of plaque is 60 lbs.

### 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. Verify all accessories with the Campus during Design Development. Also, refer to the Specific Campus Information for information from prior projects.

### 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.

## Campus Specific Information

### Texas A&M University

#### Rest Room Requirements

Verify all accessories with the Texas A&M custodial provider.

#### 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#CO<sub>2</sub> Amerex Model #315 or equal
- 10#CO<sub>2</sub> 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**

Dispensers will be furnished by SSC Service Solutions. Dispenser size and mounting information based on VonDrehle Corporation Model 2245 Hands-Free Electronic units, 8” wide towel. Actual color to be as available, also use electronic HF Dark Trans light blue top, bottom tan.

### **Water Closet Tissue Dispenser**

Dispensers will be furnished by SSC Service Solutions. Typical dispensers size and mounting information based on VonDrehle Corporation AE42V Single Junior Roll (10" diameter roll). High use areas VonDrehle Corporation 3253 Twin Junior Roll (9" diameter roll). Also, use twin junior roll Dark Trans 9" JRT. Actual color to be as available.

### **Soap Dispenser**

Dispensers will be furnished by SSC Service Solutions. Dispenser size and mounting information based on Spartan Lite'n Foamy, Black.

### **Sanitary Napkin Disposal Unit**

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

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

Two (2) American Specialties, Inc. (ASI) Model 8215-4; 20 gauge, type 304 stainless steel satin finish, projects 3 ½" from wall and is 36" long with 4 rubber cam holders ribbed for grasping.

### **Fire Extinguishers**

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

### **Interior Signage Standards**

Restrooms, Including Handicap  
(Pictogram) W/ Braille 8" X 8"

Special Room Signs W/ Braille 2 ½" X 8"

Room Signs W/ Braille 2 ½" X 6"

Office Signs W/ Braille 6" X 6"

Background color shall be maroon to match ink color. PMS 7421C. (Best Signs 398 Garnet)

All letters shall be 1” height and raised 1/32” from the background. Braille shall be raised 1/32” from background.

**Texas A&M University-Commerce**

**Rest Room Requirements**

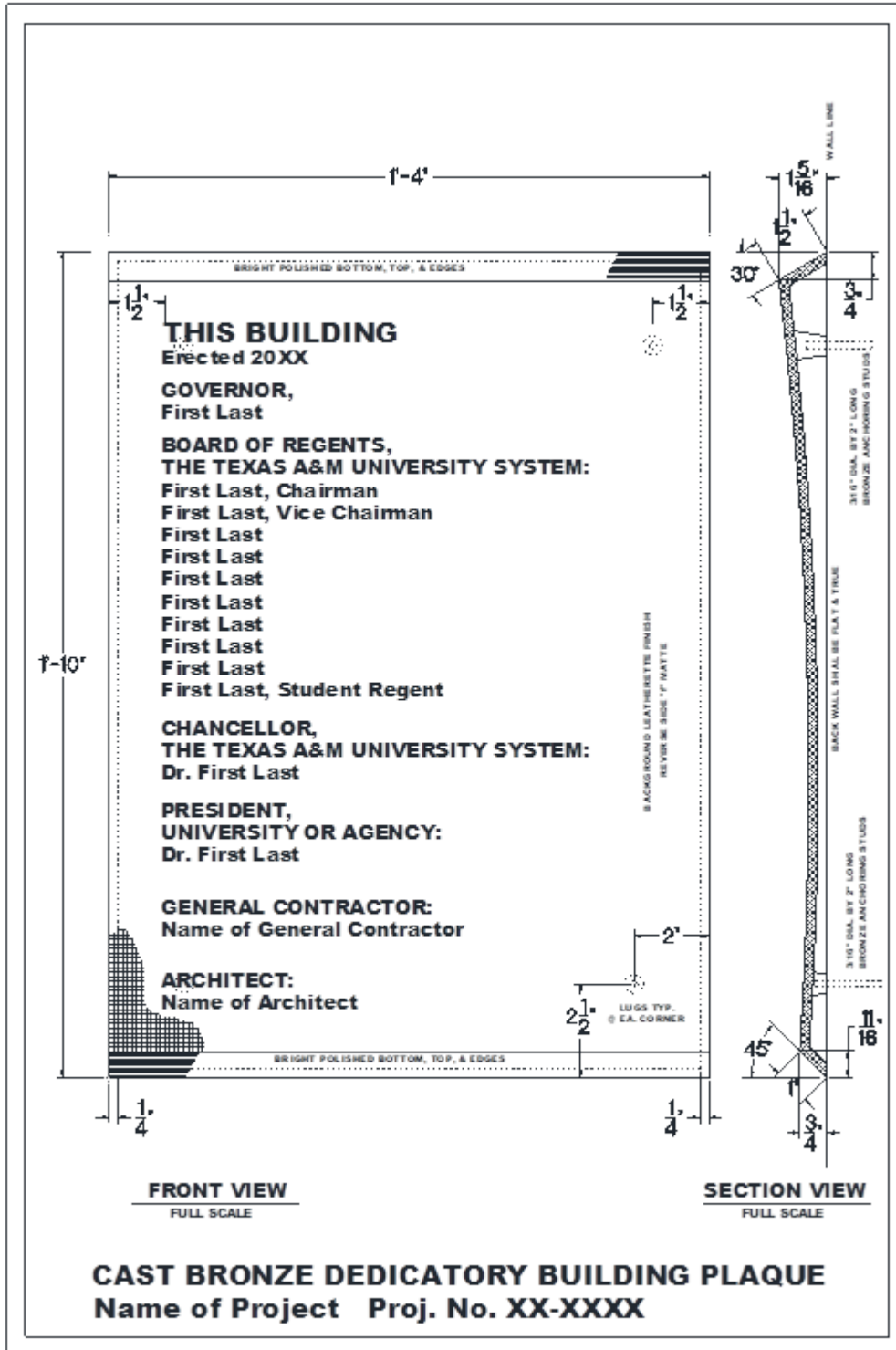
**Paper Towel Dispensers and Waste Receptacles**

Kimberly Clark Model 09994

**Water Closet Tissue Dispenser**

Kimberly Clark Model 09606

Cast Bronze Dedicatory Building Plaques





## General Information

### Audio-Visual Equipment

Projection screens, where required by the Program of Requirements, shall be motorized and controlled by a **non-keyed** switch on a wall and through the AV system.

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. Use only Type 316 stainless steel.

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. Trap guard is acceptable. Eyewash stations are required.

#### **Audio Visual Equipment**

#### **Audio Video Requirements**

Contact Department of Instructional Media for audio visual requirements for register

managed spaces.

### **Audio Visual Surveillance**

Refer to [https://it.tamu.edu/files/AVST\\_Operational\\_Standards.pdf](https://it.tamu.edu/files/AVST_Operational_Standards.pdf) for all requirements for audio visual surveillance.

## **West Texas A&M University**

### **Smart Classroom Standards**

Standard room is equipped with a lectern containing controls and computer equipment, a ceiling mounted projector, a motorized projection screen, speakers in the ceiling, a PTZ web camera, and a monitoring camera. Lectern, projector, controls, computer equipment and camera to be furnished and installed by WTAMU. Projection screen to be furnished and installed by contractor.

All lights shall be dimmable with separate switching for lights located between projector and projection screen. Light control shall be at the door and at the lectern.

Projection screen to have manual low voltage switch mounted on wall near lectern, wire from switch to screen controller to be stranded wire. Screen is to be centered on front wall. 120V power for screen to be located above the ceiling, roughly 5' off center of the room and toward the left when facing the screen. Campus standard screens: Da-Lite Advantage Electrol (34520) 130" diagonal 16:10 wide format, or (34524) 164" diagonal 16:10 wide format, actual size based on room dimensions.

Lecterns are "right-handed" from the user perspective. Floor box, located approximately 4 foot from the side wall and 5 foot from the front wall, shall contain min. 1 1/4" conduit, 1 1/2" preferred, stubbed out above ceiling for control cables; 120V power outlet and two network drops.

Projector will be suspended from the ceiling grid, at the center of the screen and approximately 14' from the screen surface. 120V power will be required above the ceiling within 4' of the projector location.

PTZ web camera will be near the center rear of the room. One network drop and one 120V outlet are required above the ceiling in the camera location

Monitoring camera location will be near the center rear of the room. One network drop are required above the ceiling in the camera location.

### 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.

## Campus Specific 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.

**Division 13 – Special Construction**

### 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 of 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. (All traction elevators to use Variable Voltage A/C, Variable Frequency Motor Control. No DC hoist motors.)
- 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

Emergency phones: must be ADA compliant hands-free push to talk phone – WURTEC S3 or equivalent. The phone must not require the person answering the phone to have to follow any

## Division 14 – Conveying Equipment

special instructions on how to establish the two-way communication or to disconnect the two way communication or to call back to the elevator. A separate phone line and phone number shall be provided for each individual elevator, this phone number shall have caller I.D. that will allow the person answering the call to know exactly which elevator is sending the call, building name, number and elevator I.D. number. (Caller I.D. shall be programmed in advance of the acceptance inspection and must work correctly before the elevator is placed into service).

B. Door Operators

1. Heavy duty, Non-Proprietary. Must include all tools to adjust and/or maintain. Include instructions for use.

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. LED, Fluorescent or screw-in base with easy access for replacement. Replacement parts must be readily available from local supply.

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.

## Division 14 – Conveying Equipment

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 LED standard 100,000 hour lamps
Flooring:	Same as adjacent area by flooring subcontractor.
Floor Lockout Provisions:	Elevators shall be capable of adding car button lock out security features without upgrading the system.
Emergency Generator:	<p>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.</p> <p>Elevators that will be powered by the buildings emergency/standby power generator must have a pre signal circuit sent to the elevator equipment 20 seconds prior to the transfer of power from normal to emergency, that will allow the elevators to automatically stop at a landing and hold their doors open until transfer is complete, also a signal circuit will need to be sent to the elevator that shows what type of power is being supplied. These signals circuits will need to come from the emergency power transfer switch and be run in conduit to near the elevator controller and be labeled as to what function they serve.</p>
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 4500 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.

## Campus Specific Information

### Texas A&M University

#### Elevator Requirements

Electric/Traction elevators are required. Oil hydraulic elevators are not acceptable.

Electric elevators: All elevator systems installed shall be the traditional type, with a machine room located directly above the hoist way for that elevator or directly adjacent to the elevator hoist way at another level.

The elevator machine room shall contain the drive machine and brake, over speed governor, emergency brake, controller and all disconnect means for the equipment. No machine room less (MRL) elevators are allowed unless approved by TAMU. Remote machine rooms are to be avoided.

## Division 14 – Conveying Equipment

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 in the "OFF" position.
  - 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.



## Division 14 – Conveying Equipment

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**
2. A heat detector must be installed within 24 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.

## Division 14 – Conveying Equipment

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.
    - B. Elevator Car Interior to Controller Communication Requirements
      1. 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:
        - a. Each two-way communication device must have emergency power back-up for at least 4 hours.
        - b. 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.
        - c. 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.
        - d. 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.
        - e. 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.

## Division 14 – Conveying Equipment

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 provider 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

## Division 14 – Conveying Equipment

- 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 elevator representative. All inspection reports shall be delivered to the campus facilities services provider.

### 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 in terms of fire protection.

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

### Fire Protection Systems

#### General

All buildings shall have automatic sprinkler system protection throughout. This applies to new construction as well as major renovations and/or modifications. Clean Agent or Water Mist Systems are permitted as a first line of defense. However, it is the interpretation of the Texas State Fire Marshal's Office that sprinkler protection is still required for all areas in accordance with NFPA 101.

Design and installation of fire protection systems shall meet the latest edition of, NFPA 13 "Standard for the Installation of Sprinkler Systems", NFPA 13R "Standard for the Installation of Sprinkler Systems In Low-Rise Residential Occupancies ", NFPA 14 "Standards for the Installation of Standpipe and Hose Systems", NFPA 20 "Standard for the Installation of Stationary Pumps for Fire Protection", NFPA 24 "Installation of Private Fire Service Mains and Their Appurtenances" and their referenced standards unless fire hazards are specifically addressed by other NFPA Codes and Standards. Fire protection drawings, calculations and listing of all equipment to be installed should be submitted to the A/E team and the "Local Authority Having Jurisdiction" for review and acceptance prior to installation. Submittals shall be in accordance with the respective NFPA Codes and Standards and incorporate any special comments and notes applicable as identified within this Design Guidelines and the respective project specifications.

The A/E shall be responsible for modeling, using BIM authoring software, and included in the Construction Documents the Fire Protection Sprinkler System identifying–Sprinkler and main locations, plans, riser locations and diagrams. Risers shall include sprinkler piping with devices for monitoring by the respective building Fire Detection and Alarm system identified. Drawings shall be laid out to allow for the additional details at completion of construction as Record Documents (As Built) including piping and fittings to each sprinkler. Record Documents shall comply with the requirements of the respective NFPA standards.

The Fire Protection Sprinkler and Standpipe System shall be designed by a Licensed Professional Engineer or a licensed Responsible Managing Employee with an organization that possesses a valid Certificate of Registration as issued by the Texas State Fire

Marshal's Office. The company shall have at least one (1) person engaged in or working on the actual plans, who is licensed to perform the work authorized by the company certificate and the individual's license issued by the Texas State Fire Marshal's Office.

### Reference Standards

The reference standards shall include the latest edition of the following as applicable:

1. ANSI-NEMA Standards: National Electrical Manufacturers Association
2. ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 24, 125, 250, and 800.
3. ANSI/ASME B16.3 Malleable Iron Threaded Fittings, Class 150 and 300.
4. ANSI/ASME B16.5 Pipe Flanges and Flanged Fittings.
5. ANSI/ASME B16.9 Factory made Wrought Steel Butt welding Fittings.
6. ANSI/ASME B16.11 Forged Steel Fittings, Socket welding and Threaded
7. ANSI/ASME B16.25 Butt welding Ends
8. ANSI/ASME B36.10 Welded and Seamless Wrought Steel Pipe
9. ANSI/ASME Sec 9 Welding and Brazing Qualifications
10. ANSI/ASTM A135 Electric Resistance Welded Steel Pipe
11. ANSI/ASTM A47 Malleable Iron Castings.
12. ANSI/ASTM B32 Solder Metal
13. ANSI/AWS A5.8 Brazing Filler Metal
14. ANSI/AWWA C110 Ductile Iron and Gray Iron Fittings
15. ANSI/AWWA C151 Ductile Iron Pipe, Centrifugally Cast
16. ASTM A53 Pipe, Steel, Black and Hot Dipped, Zinc coated Welded and Seamless
17. ASTM A795 Black and Hot Dipped Zinc Coated Welded and Seamless Steel Pipe for Fire Protection Use.
18. AWS D10.9 Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
19. NFPA 1 – “Fire Code”
20. NFPA 13 – “Installation of Sprinkler Systems”
21. NFPA 13R – “Installation of Sprinkler Systems In Low-Rise Residential Occupancies”
22. NFPA 14 – “Standpipe and Hose Systems”
23. NFPA 20 – “Standard for the Installation of Stationary Pumps for Fire Protection”
24. NFPA 24 – “Installation of Private Fire Service Mains and Their Appurtenances”
25. NFPA 25 – “Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems”
26. NFPA 45 – “Standard of Fire Protection for Laboratories Using Chemicals”
27. NFPA 70 – “National Electric Code”
28. NFPA 72 – “National Fire Alarm and Signaling Code”
29. NFPA 101 – “Life Safety Code”
30. UL Fire Protection Equipment Directory
31. Fire Code and any Standards, Guidelines, or Criteria adopted by the responding fire department. This is applicable to the extent of fire department access, water supply, fire department connections, standpipe systems and hose connections, etc.

### 32. State of Texas, State Fire Marshal Rules

#### **General Underground Water Supply to Fire Protection Systems:**

Design and installation of water supply for fire protection systems shall meet NFPA 20 “*Standard for the Installation of Stationary Pumps for Fire Protection*”, NFPA 22 “*Standard for Water Tanks for Private Fire Protection*”, NFPA 24 “*Standard for the Installation of Private Fire Service Mains and Their Appurtenances*”, NFPA 25 “*Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*” and their referenced standards.

New Fire Hydrants shall comply with NFPA 24. Fire Department Connection shall be within 100 feet of the nearest fire hydrant. The A/E shall verify with the Local AHJ if 5-inch quick connect devices (i.e. Storz type) are required on fire hydrants and fire department connections. Quick connect devices shall be UL Listed.

The underground fire protection supply should have a PIV.

Underground piping for fire protection use shall have the acceptance requirements of NFPA 24 met. This includes flushing of piping based on minimum flow rate identified by size of pipe within NFPA 24. If the piping will serve a fire pump, the minimum flow rate shall be in accordance with NFPA 20. Hydrostatic testing is also required. The Contractor shall provide a “Contractor’s Material and Test Certificate for Underground Piping” in accordance with NFPA 24. The “Contractor’s Material and Test Certificate for Underground Piping” shall be submitted by a licensed RME-U with the Texas State Fire Marshal’s Office or provide documentation of equal qualifications. The “Local Authority Having Jurisdiction” shall be invited to witness flushing and hydrostatic testing.

#### **Fire Pumps:**

Fire pumps shall be UL Listed and FM Approved.

Provide concrete pads for the fire pump, fire pump controller, and pressure maintenance pump (jockey).

All elastomeric couplings are prohibited. Alignment of fire pump shall be done by digital means. A report including the digital readings from alignment shall be included with the pre-test checklist.

Drain lines from the fire pump cup drain to the floor drain shall be CPVC piping. (This is ONLY for the drain line from the cup drain to the floor drain.)

Fire Pump start-up shall be performed, documented, and transmitted to all parties prior to the Acceptance test. Acceptance testing of fire pump to be witnessed by a combination of representatives from Texas A&M University System Office of Risk Management, the

“Local Authority Having Jurisdiction”, and/or their designated representatives (Third Party Inspectors).

### **Standpipe System Design:**

Design of the Standpipe System shall be in accordance with NFPA 14 “*Standard for the Installation of Standpipe and Hose Systems*”:

- 500 gpm at the most hydraulically remote hose connection
- 250 gpm at the each of the other standpipes
- Total flow permitted to be 1,000 gpm IF building protected throughout with automatic sprinkler system (NFPA 13).
- Design with a minimum 100 psi residual pressure at the most hydraulically remote hose connection

System acceptance testing to include flow test of the standpipe system in accordance with the design criteria:

- 500 gpm flow at the top of the most hydraulically remote standpipe
- 250 gpm flow at each of the remaining standpipes up to 1,000 gpm IF the building is protected by automatic sprinkler system throughout (NFPA 13)
- Measure minimum 100 psi residual pressure at the most hydraulically remote hose connection

Hoses need not be installed unless specifically required by other NFPA Codes and Standards.

Standpipe piping shall be Schedule 40 black steel pipe conforming to ASTM A-53 or ASTM A-795. Minimum size of standpipe piping shall be 6-inches in accordance with NFPA 14.

Air ejectors/air vents are required at the top of each standpipe as required by NFPA 14. Air ejectors shall be piped into main and express drains when required by the manufacturer’s installation instructions.

All aboveground piping shall be flushed to verify no shipping caps, cutouts/coupons, or other debris is left within the pipe. Flushing shall be witnessed by the “Local Authority Having Jurisdiction” and/or their designated representatives.

Inspections and testing shall comply with NFPA 14, NFPA 20, NFPA 24, these Guidelines, and any insurance carrier requirements. The referenced pre-test checklists shall be used to verify systems are ready for final inspection and witnessing of integrated acceptance testing by the “Local Authority Having Jurisdiction” and/or their designated representatives.



### **Automatic Sprinkler System:**

#### ***Design Criteria:***

Provide water supply flow test data identifying the location, flow characteristics, and the source of the data. Specify that it is the Contractors responsibility to verify the flow test information prior to completing the shop submittal hydraulic calculations. The flow test data shall not be more than one (1) year old.

Automatic sprinkler system design criteria shall meet the requirements of NFPA 13. During project design, the A/E shall consult with the Local AHJ and the insurance carrier to verify no additional criteria is required.

All materials shall be UL Listed and FM Approved products. The UL Certifications Directory and the FM Approval Guide are available online. Registration for access to the Approval Guide is free.

Fire Department Connection shall be within 100 feet of the nearest fire hydrant.

#### ***Pipe and Fittings:***

Compliance with Article 5.43.3 of the Texas Insurance Code and NFPA Codes and Standards 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. Drains can be piped directly to the outside only when approved in writing by the Owner representative and Local AHJ.

All piping to be Schedule 40 black steel pipe in accordance with ASTM A-53 or ASTM A-795. All Schedule 40 pipe shall be fully reamed. All grooved pipe shall be roll grooved. Cut grooved pipe is not permitted.

Internally galvanized piping is not permitted other than for drain piping only. All piping exposed to open atmosphere shall be treated. If internally galvanized pipe is the only option in the situation of being exposed to open atmosphere, galvanized pipe may be utilized. However, no welding shall be performed after the hot dipped galvanized process.

Grooved pipe is acceptable for fire protection systems for piping greater than 2 inches in diameter. Piping 2 inches in diameter and less shall be threaded.

Provide insulation and heat tracing for fire protection piping in crawl spaces and other areas in which the temperature could drop below 40 degrees Fahrenheit such as loading docks, drive thrus, exterior stairs or canopies.

Provide a cleaning specification for sprinkler piping. Clearly specify requirements for maintaining caps on pipe stored on the jobsite.

All piping for armovers shall tie into the top of the branchline instead of the side or bottom.

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

If flexible piping (i.e. FlexHead etc.) is proposed; it shall be UL Listed and FM Approved. Provide with product data, a copy of the UL Listing and FM Approval identifying the allowable bend radius and number of bends. Flexible piping shall be limited to a maximum of 48 inches in length. Provide additional specification inspection criteria for flexible piping. Bend radius and number of bends shall not exceed that identified by UL Listing and FM Approval, whichever is most restrictive. Inspection shall be coordinated such that the ceiling grid is in as well as the ceiling tiles for the flexible piping sprinkler drop ONLY. All other tiles shall not be installed at the time of the flexible piping inspection. Inspection shall include support screws into the ceiling grid, deflector location below ceiling grid elevation, and support of sprinkler drop to support grid.

All fittings and couplings shall be UL Listed and FM Approved. Size on size (weld-o-let type) fittings are not acceptable. Snap joint couplings, mechanical-T style couplings, pressfit couplings, outlet couplings, reducing couplings, cut-in style couplings, and plain end type couplings are not permitted.

Piping greater than 2-inches may be rolled grooved with grooved fittings. Piping 2-inches and smaller shall be threaded with malleable iron fittings and couplings.

Bushings are prohibited.

### ***Automatic Air Vents***

Air ejectors are required on every floor with an automatic sprinkler system in accordance with NFPA 13. These air ejectors shall be located at the remote test drain assembly or at the highest elevation of the respective sprinkler system. These air vents are to be piped to the remote express drain or nearest suitable drain termination point in accordance with the manufacturer's instructions. Manual is preferred over automatic.

### ***Flushing, Inspections, and Integrated Acceptance Testing***

All aboveground piping shall be flushed to verify no shipping caps, cutouts/coupons, or other debris is left within the pipe. The flushing shall occur before sprinklers are installed. The one exception is flushing when ONLY upright sprinklers are in place. Flushing shall be witnessed by the "Local Authority Having Jurisdiction" and/or their designated representatives.

Inspections and testing shall comply with NFPA 13, NFPA 20, NFPA 24, these Guidelines, and any insurance carrier requirements. The referenced pre-test checklists shall be used to verify systems are ready for final inspection and witnessing of integrated acceptance testing by the "Local Authority Having Jurisdiction" and/or their designated representatives.

### ***Special Occupancies***

#### **Mechanical/HVAC Equipment Rooms:**

If the equipment room does not contain oil-filled electrical equipment or other flammable liquids, Fire protection should be designed to Ordinary Hazard Group 1 .

#### **Electrical Rooms/Switchgear Rooms:**

ALL Electrical/switchgear rooms SHALL have automatic sprinkler protection except the Main Electrical Room and the Emergency Electrical Room. Note that the recommended preference of the Texas State Fire Marshal's Office is to provide automatic sprinkler protection in all electrical/switchgear rooms including the Main Electrical Room and the Emergency Electrical Room. When the exception is used, these two rooms shall comply with NFPA 13 and have the following features:

- The electrical/switchgear rooms are provided with a 2-hr fire rated enclosure. The enclosure shall include the floor/ceiling assembly separating the electrical/switchgear room from adjacent building areas above and below the respective electrical/switchgear room.
- UL Listed Monitored 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 shall be designed for Ordinary Hazard Group 2

#### **Data Centers:**

Wet sprinkler systems or pre-action systems are recommended, and should include 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 NFPA 75 “Standard for the Fire Protection of Information Technology Equipment”, NFPA 76 “Standard for the Fire Protection of Telecommunications Facilities” where applicable, and NFPA 13 “Standard for the Installation of Sprinkler Systems”. A sprinkler design density for Ordinary Hazard Group 1 shall be provided..

Clean Agent or Water Mist Systems are permitted as a first line of defense, however, it is the interpretation of the Texas State Fire Marshal's Office that sprinkler protection still be provided for all areas in accordance with NFPA 101 Section 9.8.1.

#### **Emergency Generator Rooms:**

Provide automatic sprinkler protection in the generator room designed to Ordinary Hazard Group 2.

### **FDC Signage**

FDC signage shall comply with the requirements of the Texas State Fire Marshal's Office Notice dated May 2016. Fire Department Connection Signage shall include:

- Building Identification
- Building Location
- Fire Protection Systems served (Sprinkler and/or Standpipe system)
- Identify if there is a Fire Pump
- Identify main building riser location or fire pump room location
- Inlet pressure required by fire department equipment to meet system demand

See respective system Member (University) information for additional details.

### **Clean Agent Fire Extinguishing Systems**

All special protection systems should be installed in accordance with, NFPA 2001 “*Standard on 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 with NFPA 2001 “*Standard on Clean Agent Fire Extinguishing Systems*”. Clean Agent Systems are permitted as a first line of defense, however, it is the interpretation of the Texas State Fire Marshal’s Office that sprinkler protection still be provided for all areas in accordance with NFPA 101 Section 9.8.1.

The clean agent fire extinguishing system shall be UL Listed and FM Approved.

The system shall be designed and installed by an experienced firm regularly engaged with automatic total flooding 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 Texas State Fire Marshal’s Office in accordance with Article 5.43.1 of the Texas Insurance Code.

The contractor must perform two (2) tests for total flooding fire suppression systems.

### **Water Mist Systems**

A UL Listed and FM Approved Water Mist System is acceptable if all criteria outlined in NFPA 750 “*Standard on Water Mist Fire Protection Systems*” are satisfied. Water Mist Systems are permitted as a first line of defense, however, it is the interpretation of the Texas State Fire Marshal’s Office that sprinkler protection still be provided for all areas in accordance with NFPA 101 Section 9.8.1. The Water Mist System must be UL Listed and FM Approved for that specific application. If not in accordance with a specific application, an Alternate Method of Compliance is required.

## Campus Specific Information

### **RELLIS (01)**

The RELLIS Facilities Design Guidelines can be found at <https://rellis.tamus.edu/campus-management/facilities-design-guidelines/>. Or contact the RELLIS Environmental Health & Safety Manager.

### **Texas A&M University (02)**

Refer to the “Supplemental Design, Installation, And Acceptance Guide for Fire and Life Safety systems”. Contact TAMU Environmental Health & Safety. Supplemental guide available at [tamu-fire-safety-design-installation-acceptance-guide-for-fire-and-life-safety-systems-4-26-2018.pdf](https://www.tamu.edu/ehs/docs/tamu-fire-safety-design-installation-acceptance-guide-for-fire-and-life-safety-systems-4-26-2018.pdf).

### **Texas A&M University at Galveston (10)**

#### **Fire Department Access and Lock Box**

Knox Box Model: Knox Vault 4400 dual lock model.

#### **Fire Hydrants**

Fire Hydrants shall be AWWA C502 Dry Barrel type. Specific model shall be Mueller Super Centurian 250, American Darling B84B, or approved equal. All hydrants shall have a 5 inch Storz steamer connection.

#### **Fire Department Connections, PIV and Standpipes**

Fire Department Connections shall be 5 inch quick connect. Fire Department connections shall have Knox FDC Cap Model with dual keys and key wrench.

Fire Department Hose Valves shall have Knox caps (Knox Standpipe Lock).

#### **Additional Information**

For other specific criteria contact the Environmental Health & Safety Department at Texas A&M University at Galveston. Their website is <http://www.tamug.edu/environmentalhealthsafety/index.html>.

### **Prairie View A&M University (05)**

#### **Fire Department Access and Lock Box**

Knox Box Model: Knox 3275. All Knox boxes to be installed at 60 inches above finished

grade.

### **Fire Hydrants**

Fire Hydrants shall be Mueller Super Centurian 250. All hydrants shall have a 5 inch Storz steamer connection.

### **Fire Department Connections, PIV and Standpipes**

The system PIV shall have a Knox lock.

If a building is required to have a Standpipe System, it shall be an automatic standpipe system. Manual standpipe systems are not permitted.

### **Additional Information**

For other specific criteria contact the Prairie View A&M University Fire Marshal within the University Police Department. Their website is <https://www.pvamu.edu/upd/fire-and-life-safety/>

### **Tarleton State University (04)**

#### **Fire Department Access and Lock Box**

Knox Box Model: Knox 3200 Series. Shall be mounted 60 inches above finished grade.

#### **Fire Department Connections, PIV and Standpipes**

Fire Department Connections shall have Knox FDC caps. Standpipe fire department hose valves shall have Knox caps.

#### **Additional Information**

For other specific criteria contact the Risk Management and Compliance Department at Tarleton State University. Their website is <https://www.tarleton.edu/safety/index.html>

### **Texas A&M International University (16)**

#### **Fire Department Access and Lock Box**

Knox Box Model: Knox 3200 Series. Shall be mounted at a height acceptable to the Laredo Fire Department.

#### **Fire Hydrants**

## Division 21 – Fire Suppression

Fire Hydrants shall be Mueller 5 ¼ 584N or Kennedy Guardian 5 ¼ K81D.

### **Additional Information**

For other specific criteria contact the Environmental Health & Safety Department at Texas A&M International University. Their website is <https://www.tamiu.edu/adminis/safety/index.shtml>

### **Texas A&M University – Corpus Christi (15)**

For other specific criteria contact the Environmental Health & Safety Department at Texas A&M University Corpus Christi. Their website is <https://safety.tamucc.edu/>

### **Texas A&M University – Kingsville (17)**

#### **Fire Department Access and Lock Box**

Knox Box Model: Knox 3273. Knox box shall be mounted at a height 6 feet or 72 inches to center above finished grade.

#### **Fire Department Connection Signage**

In accordance with agreement with Kingsville Fire Department, FDC signage to indicate:  
FDC  
Sprinkler System and or Standpipe System

### **Additional Information**

For other specific criteria contact the Environmental Health and Safety Office within Facilities Planning and Construction at Texas A&M University Kingsville. Their website is <https://www.tamuk.edu/finance/fpc/ehs/index.html>

### **West Texas A&M University (18)**

#### **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.

Fire protection piping in the tunnel is to utilize Nibco Valves with wheel operators for supply and drain dump valves in tunnels.

For other specific criteria contact the Department of Fire and Life Safety – Environmental Health and Safety at West Texas A&M University. Their website is <https://www.wtamu.edu/research/compliance-safety-resources/fire-life-safety/index.html>

### **Texas A&M University – Commerce (21)**

For other specific criteria contact the Department of Campus Operations and Safety at Texas A&M University Commerce. Their website is <https://inside.tamuc.edu/facultystaffservices/riskManagementSafety/fireAndLifeSafety/default.aspx>

### **Texas A&M University – Texarkana (22)**

For other specific criteria contact the Environmental Health & Safety Department at Texas A&M University Texarkana. Their website is <http://tamut.edu/About/Administration/Environmental-Health-and-Safety/index.html>

### **Texas A&M University – Central Texas (24)**

#### **Fire Department Access and Lock Box**

Knox Box Model: Shall be mounted 60 inches above finished grade.

#### **Fire Extinguisher Cabinets**

Fire extinguisher cabinets shall be JL Industries Ambassador Series model 1017F10 with full glass door and 3-inch trim equal to those found in Founders and Warriors Halls. Any proposed alternative must be approved by the Local Authority Having Jurisdiction.

#### **Additional Information**

For other specific criteria contact the Safety and Risk Management Department at Texas A&M University Central Texas. Their website is <https://www.tamuct.edu/risk-management/>



**Texas A&M University – San Antonio (25)**

For other specific criteria contact the Office of Safety and Risk Management at Texas A&M University San Antonio. Their website is <https://www.tamusa.edu/businessaffairs/riskmanagement/index.html>

## Division 21 – Fire Suppression

### Performance Requirements

The following are baseline minimum performance requirements for plumbing systems. It is common for individual projects to have additional requirements;

#### Plumbing Code

The project shall be designed to comply with the International Plumbing Code (latest edition)

#### Water Conservation Standards

The project shall be designed to comply with the Texas Water Conservation Design Standards for State Buildings and Institutions of Higher Education Facilities

#### Energy Code

The service hot water system shall comply with the energy code (Either IECC 2015 or ASHRAE 90.1 2013 as selected by the design team at Schematic Design)

### Prescriptive Design and Specifications Standards

#### Required Documentation

Submit plumbing calculations with the Design Development submittal

Performance data for all plumbing equipment shall be shown in schedules on the drawings

Provide riser diagrams to show all waste, vent, supply piping, and cleanouts

### Campus Specific Information

#### Texas A&M University

The Utilities and Energy Services department at Texas A&M University in College Station maintains prescriptive design standards for underground plumbing utilities outside of the building. These standards are found at <https://utilities.tamu.edu/design-standards/> . Other campuses will either have standards of their own or use the College Station standards by default. The plumbing systems covered by these standards are:

High Density Polyethylene (HDPE) Piping Installations  
Piping, Equipment, and Structure Color and Identification  
Storm Drainage Utilities

Utility Metering  
Underground Piping Systems  
Procedures for Receiving and Disconnecting Temporary and Permanent Utility Services

### **Domestic Water and Domestic Hot Water**

Provide frost proof hose bibs on exterior of buildings.

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.

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

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.

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

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

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

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.

Each restroom shall have at least one hose bib with a vacuum breaker provided.

Provide stainless steel access doors for restrooms.

All systems shall be sterilized to meet health department requirements

Grooved joint piping systems may be used on fire protection systems for piping 2-1/2 inches and larger only.

### **Roof Drains and Storm Water**

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

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

All no-hub cast iron to be provided with hangers within 18" of the hub on each side.

### Sanitary Sewer

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

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

Cleanouts shall be located at each bend and every 50 feet in straight runs.

All no-hub cast iron to be provided with hangers within 18" of the hub on each side.

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.

Each rest room shall have at least one 4" floor drain when serving 80 or more square ft. and 3" min. for less area.

### Laboratories

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

Provide drum sediment traps for all fume hoods and lab sink drains.

### Natural Gas Piping

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

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.

## West Texas A&M University

### General Practice

Provide individual isolation valves for each restroom with an accessible access door.

All clean outs to be above the flood level rim of fixtures.

Utilize PVC caps on all clean outs, not brass.

Floor drains provide w/ elastomeric PVC duck bill insert as manufactured by “Trap Guard”.

All piping installed outside of building footprint to include tracer wire with accessible tracer points.

### Flush Valves

Urinal flush valves shall be no more than 1.0 gallon per flush or 0.125 gallons per flush (coordinate with urinal model). Closet flush valves shall be no more than 1.6 gallons per flush.

Urinal - Sloan Royal Flushometer Model 186-1 or Closets - Sloan Royal Flushometer Model 111

### Fixtures

Water Closets Wall Hung:

Kohler - K-4330 Kingston Lite 1.6 gal per flush. Elongated bowl, wall hung with 1-1/2" top spud.

Water Closets Floor Mount:

Kohler - K-4350 Wellconune Lite 1.6 gal per flush. Elongated bowl, floor mount, 12" rough with 1-1/2" top spud.

Water Closets Tank Type Floor Mount:

Kohler - K3420 Wellworth Lite. Elongated toilet combination, 12" rough.

Handicapped Water Closet:

Kohler - K-3544 Highline Lite PC. Elongated toilet combination, 18" high, 12" rough.

Urinals:

New Installation – Kohler Dexter K-5016-ET, 1.0 gal per flush washout urinal with 3/4" top spud

## Division 22 – Plumbing

or Kohler Dexter K-5452-ET, 1-Pint Urinal with ¾" top Spud  
Residence Hall Replacements - Kohler - K-4960-T Bardon Lite 1.0 gal per flush washout urinal with ¾" top spud.

Lavatories - Wall Hung:

Kohler - K-2032 Greenwich Three (3) hole drilled on 4" centers, vitreous china. (Install blocking or solid backing for fixture support)

Lavatory Trim:

1-1/4" PO Plugs with grid strainer, 17ga chrome plated, 1-1/4" P-Traps.

Sink Trim:

Basket Strainers - Stainless steel basket, neoprene stopper. Polished Chrome - Sanitary Dash #SS250 or equivalent.

P-Traps – 1 1/2" 17ga chrome plated.

Continuous Waste – 1 1/2" - 17ga chrome plated.

### Faucets

Lavatory:

Delta Model 501 – 4" Centerset less pop-up with metal handle and no pop-up rod hole, chrome plated finish.

Sink:

Delta Model 100 – 8" Centerset deck mount faucet less spray with single lever metal handle, and 8" swing spout - chrome plated.

Delta Model 300 - 8" Centerset deck mount faucet with spray mounted on the escutcheon plate, single lever metal handle, and 8" swing spout, chrome plated.

Shower Valves:

Delta Model T14085, single handle, R10000-UNWS pressure balanced shower valve with Scald-Guard valving, solid brass body, lever handle, field adjustable temperature stop, screwdriver stops, chrome finish.

Tub and Shower Valves:

Delta Model 1648 - Single Handle Scald Guard Tub and Shower Valve - 8" tub and shower valve with I.P. unions, integral screwdriver stops, shower head, shower arm, shower arm escutcheon, heavy duty divertop spout, and metal lever handle. Temperature controlled only with handle, chrome plated.

Shower Head:

Sloan model AC-11, ANSI/ASME A112.18.1M, spring loaded self-cleaning spray disk, "Cone-within-a-cone" spray pattern, pressure compensating for maximum flow 2.5 gpm, brass construction, universal ball joint with thumb screw volume control, spray arm

with set screw flange, polished brass.

### Kitchen Sink:

Kohler - K-5943 Brookfield enameled cast iron 33" x 22" self-rimming. Three (3) hole drilling.

### Bathtub:

Kohler - K-505 Lefthand Kohler - K-506 Righthand  
Enameled cast iron - 60" x 32" x 16" recess bath with safeguard finish.

### Service Sink:

Kohler K-6716 Bannon - enameled cast iron service sink with K8936 rim guard, drilled back, 22 x 18 with 6672 Trap.

### Service Sink Faucet:

Kohler - K-8906 Knoxford service sink faucet with vacuum breaker, threaded spout, pail hook, wall brace with key stops.

## Drinking Fountains

Standard Wall Hung: Elkay Model EWA-8 Deluxe Floor Model: Elkay Model EFA-8  
Barrier Free Wall Hung: Elkay Model EBFSA-8

Bottle filler model to be included on low fixture with high/low installation. Acceptable alternate: Oasis Brand with same features as Elkay

## Water Piping, Above Grade, in building

Copper Tubing: ASTM B88, Type L, hard drawn. Fittings: ASME B16.22, wrought copper.

Joints: ASTM B32, solder, Grade 95TA.

Domestic Water: Gate Valves NO BUTTERFLY VALVES ON DOMESTIC WATER LINES

Non- Domestic Water: Ball Valves & Butterfly Valves

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.



## Division 23 – Heating, Ventilating and Air Conditioning

### Performance Requirements

The following are baseline minimum performance requirements for mechanical systems. It is possible for the project Program of Requirements to have requirements that deviate from or exceed these minimums:

#### Energy Code

The energy code will be selected as a part of the Schematic Design process. The project shall comply with the energy code and shall exceed the code as required in other sections of the Facility Design Guidelines. The Energy Code will be either the 2018 International Energy Conservation Code or ASHRAE 90.1-2016

#### Mechanical Code

The design is to comply with the latest edition of the International Mechanical Code.

#### Dry Bulb Temperature

For offices, conference Rooms, and classrooms the indoor design conditions shall be a maximum 72 degrees F for heating and a minimum 75 degrees F for cooling. (IECC 2015) The controls shall provide for seasonal and unoccupied temperature reset.

For laboratories that are driven by minimum ventilation requirements the minimum cooling design condition shall be 72 degrees F in order to minimize the amount of reheat required

For Mechanical Rooms, Electrical Rooms, Janitors Rooms, and Storage Rooms the minimum cooling design temperature shall be 80 degrees F.

For stairwells, the design conditions shall be specified by the engineer of record.

#### Humidity

Provide a maximum 55 degrees F dew point.

#### Air Movement

Provide less than 40 feet per minute air speed at the occupied level

#### Pressurization

Provide building positive pressure when occupied and when outside dew point is greater

## Division 23 – Heating, Ventilating and Air Conditioning

than 47 degrees F.

Laboratories generally are maintained under negative pressure in relation to the corridor of other less hazardous spaces. Specific laboratory pressurization requirements are to be confirmed with the Environmental, Safety, and Health officer for the campus.

### Ventilation

Provide ventilation rates per the International Mechanical Code (or ASHRAE 62.2-2013 if the ASHRAE 90.1-2010 energy code is being used). Provide demand controlled ventilation when required by IECC2015 or ASHRAE 90.1-2013.

Laboratory ventilation rates are established by the Environmental Safety and Health Officer for each campus. If the EHS officer has no specific requirements then the baseline design shall be 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.

Laboratory 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.

### Filtration

Filtration performance requirements are to be specified by the engineer of record. Currently, the need to get LEED points is driving the specified filtration performance levels above what is required by ASHRAE 62.1-2013

### HVAC Noise Control

Design all systems so that space Room Criteria (RC) is equal to or less than those listed in 2011 ASHRAE Applications, Chapter 48, Noise and Vibration Control, Table 1, Design Guidelines for HVAC Related Background Sound in Rooms

## Prescriptive Design and Specifications Requirements

### Required Documentation

### Design Criteria

The outdoor design condition criteria are to be established by the engineer of record using the latest edition of the ASHRAE Handbook of Fundamentals. The design criteria

## **Division 23 – Heating, Ventilating and Air Conditioning**

shall be shown on the General Information sheet of the mechanical drawings and be included in the Basis of Design narrative.

### **Building Ventilation Schedule**

The Building Ventilation Schedule for all spaces shall be included in the Basis of Design narrative at the Design Development and the Construction Document phase.

### **Building Pressurization Table**

The Building Pressurization Table shall be included in the Basis of Design narrative at the Design Development and the Construction Document phase.

### **Occupancy Loads**

The occupancy loads shall be included in the Basis of Design narrative at the Design Development and the Construction Document phase.

### **HVAC Load Calculations**

The HVAC load calculations shall be included in the Basis of Design narrative at the Design Development and the Construction Document phase.

### **Energy Analysis**

An analysis for compliance with the energy goals shall be included in the Basis of Design narrative at the Design Development and the Construction Document phase.

### **Schematic Flow Diagrams**

Schematic flow diagrams for air, cooling water, and heating water systems shall be included in the drawings.

### **Site Plans**

Site plans showing new and existing thermal lines and the limits of construction shall be included in the drawings at all phases

### **Floor Plans**

The Design Development drawings shall include floor plans showing a single line layout for supply air, return air, and exhaust air. The drawings shall also include enlarged mechanical room plans showing all equipment and access

### Campus Specific Design Standards

#### Texas A&M University

The Utilities and Energy Services department at Texas A&M University in College Station, Texas maintains prescriptive design standards for many mechanical systems. These standards are found at <https://utilities.tamu.edu/design-standards/>. Other campuses will either have standards of their own for these systems or use the College Station campus standards by default. The systems covered by these standards are:

- Building Automation Systems
- Electric Motors
- High Density Polyethylene (HDPE) piping Systems
- Hydronic Piping in Buildings
- Interconnection of Building Hydronic Systems to Campus Utility Infrastructure
- Laboratory Control Systems
- Piping Equipment and Structure Color and Identification
- Procedures for Receiving and Disconnecting temporary and Permanent Utility Services
- Thermal Systems (Chilled & Hot Water)
- Utility Metering
- Underground Piping Systems

#### Hydronic Piping

In addition to the campus specific design standards:

Pipes in crawl spaces and other spaces subject to condensation must be insulated with non-permeable insulation such as cellular glass.

All pressure piping shall be tested at 150 psi or greater for 4 hour minimum.

All hangers shall be hot dipped galvanized in the crawl space and wet areas and cad plated otherwise as long as the crawl space is well ventilated.

All ball valves shall be two piece threaded 600 with stainless steel ball and stem.

All gate valves to be rising stem, but might prefer ball or butterfly valves.

For steel piping the basis of design shall be threaded iron malleable iron fittings for 2 inch and under and welded schedule 40 fittings for 2.5 inch and larger.

For copper piping the basis of design shall be brazed or soldered fittings. The engineer of record may recommend specific press seal fitting for alternate pricing. Fittings underground copper shall be brazed.

## Division 23 – Heating, Ventilating and Air Conditioning

All condensate drain lines shall be insulated. In exposed areas insulation shall be premolded.

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, loose fill are not acceptable

All auto air vents shall be constructed with a cast iron body and stainless steel ball and seat. The auto vents shall be piped to waste.

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.

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.

### **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).

## Division 23 – Heating, Ventilating and Air Conditioning

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), control valves and flow meters or devices that could be damaged during the flushing.

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.

### **Duct Systems**

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.

## Division 23 – Heating, Ventilating and Air Conditioning

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. It will deteriorate and create a “never ending” mess.

Provide hangers for all slot diffusers and insulate. Provide detail on drawings.

Provide hinged access doors for duct access.

Provide air foil turning vanes.

All large round ducts 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.

All ducts to be fabricated from G-90 galvanized materials.

Foil backed tape on ducts is not permitted. This tape peels back over time. Use fiberglass mesh and vapor barrier sealant with the 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.

Acoustic duct lining used in air systems shall be non-fiberglass material impregnated with an anti-microbial agent. Joints shall be butted together and adhesive applied to edges.

All transfer air openings shall be sized with no more than 300 feet per minute air velocity

### **Mechanical Equipment Rooms**

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.

When condensate waste recovery systems are installed, coordinate with division 22 for a designated drain near the equipment cast in the concrete 2" above the floor.

Provide positive ventilation in all equipment rooms that are not return air plenums.

## Division 23 – Heating, Ventilating and Air Conditioning

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.

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.

Housekeeping pads for the floor mounted equipment shall be minimum 6 inches high (or as needed for proper drainage of AHU equipment) and shall extend minimum 4 inches beyond on all sides of the equipment that they support.

Refer the Architectural Design section of the Facility Design Guidelines for additional mechanical room requirements.

### Laboratory Exhaust

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

Refer to Division 11 in the Facility Design Guidelines for additional fume hood requirements.

### 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.
5. Provide and install means for future chemical treatment.



## **Division 23 – Heating, Ventilating and Air Conditioning**

For buildings with dedicated heating water boiler plants: Modular boilers are to be used and with a minimum of two equally sized boilers sized at 67 percent of peak demand.

### **Chiller Plants**

For buildings that have dedicated chiller plants: If the total cooling load is 1000 tons or more a minimum of three chillers must be provided. If less than 1000 tons, a minimum of two equally sized chillers at 67 percent of the peak capacity must be provided.

### **Roof Mounted Equipment**

Mechanical equipment, except for cooling towers, air cooled chillers, and exhaust fans is not permitted on the roof of the building unless a conditioned mechanical penthouse is provided. Access to roof mounted equipment must be by stairs or freight elevator; ships ladders are not permitted.

### **Testing and Balancing**

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**

#### **Casings**

AHU housing must consist of formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components

Units shall have access doors, minimum 15½” width, to access both sides of the coils, filters, fan section and mixing box sections.

G90 Galvanize all parts of the unit, inside and out, including supports.

AHU units shall be built on a minimum of six inch high rails.

Drain pans shall be of stainless steel double wall construction, 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

The Engineer of Record shall specify AHU casing leakage and deflection limits that satisfy the equipment service life specified in the program of requirements. The

## Division 23 – Heating, Ventilating and Air Conditioning

contractor's scope of supply shall include field leakage testing of one unit of each type that is used in the project.

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.

AHU shall be constructed for a maximum 1% allowable leakage of the rated air flow at +/- 8 inch w.g.

Minimum space between coils, energy recovery devices and heating elements in the air handling units shall be 15½" for cleaning coils.

Safety latches shall be required on the fan section

### Fans

The fans are to be specified by the engineer of record.

### Coils

Cooling coils must be selected at or below 500 feet per minute face velocity. Heating coils must be selected at or below 750 feet per minute face velocity.

HVAC coils subject to outside air in hot, humid, and marine climates shall be provided with copper tubes and copper fins or electro coated copper tubes with electro coated aluminum fins with a coating thickness to be maintained between 0.6 mil and 1.2 mil and with a minimum salt spray resistance of 6,000 hours.

Individual finned-tube cooling coils, five or fewer rows may have a maximum 12 fins per inch. Individual finned-tube cooling coils of six rows or more shall not exceed 10 fins per inch.

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.

### Filters

The filters are to be specified by the engineer of record.

## Division 23 – Heating, Ventilating and Air Conditioning

### Controls

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.

### Electrical

All units with a motor rated at 10 horsepower and larger, shall be furnished with and internal 120 VAC light. Wiring thru casing shall be sealed internally at penetrations

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, controls, power wiring to prevent condensation in the connections.

### Variable Air Volume Terminal Units

Single duct terminal boxes are to be selected with the maximum scheduled CFM to be lower than 80 percent of the box listed capacity.

Boxes are to be delivered to the jobsite fully assembled with air dampers, heating coil, self-contained volume regulator, flow sensor, and disconnect switch. All controls shall be supplied by the ATC contractor to the box manufacturer for factory installation.

The damper actuator must be factory installed by the box manufacturer. All required linkages must be furnished and factory installed and performance tested by the box manufacturer

Samples of each type terminal units will be selected by the Owner for testing of case and damper leakage. The test will be done at the Testing and Balancing firm's facility. The engineer of record is to provide leakage requirements in the specifications.

### Building Controls

The Utilities and Energy Services department at Texas A&M University in College Station, Texas maintains prescriptive design standards for Building Automation Systems and Laboratory Controls. These standards are found at <https://utilities.tamu.edu/design-standards/>. In addition to these standards, TAMU – UES has undocumented requirements for sequences of operation, design details, and control network architecture. These requirements are fluid and the engineer shall initiate a meeting with TAMUS – UES at the beginning of the project to discover and

## Division 23 – Heating, Ventilating and Air Conditioning

document these requirements.

### Other TAMU System Campuses

#### Building Controls

The other TAMU System campuses have largely undocumented controls requirements and the engineer will need to conduct discovery at the beginning of the project. If no requirements are found then the engineer shall default to the College Station Campus requirement for use as the basis of design

**General Information**

**Not Used – Refer to Division 23**

## Division 25 – Integrated Automation

## Division 25 – Integrated Automation

## General Information

The A/E shall not leave engineering calculations to contractor. Calculations such as load flow, short circuit, arc-flash, K-factor, THD, duct bank heat analysis, and pull calculations shall be the responsibility of the A/E. All studies shall be performed by or under direct supervision of a Licensed P.E. (Electrical)

Where the NEC uses terms similar to “by special permission,” obtain written permission from TAMUS.

## Power System Studies

The scope of all power system studies shall begin at the project connection to the medium-voltage utility system (including the primary fuse or circuit breaker) and extend to the low-voltage distribution system branch-circuit overcurrent protective devices. The results of all studies should be displayed as paired to equipment on One-line diagrams at 100% CD.

Perform power system studies and analyses according to the methods of IEEE 399. For power system networks having parallel paths, perform a load flow analysis in accordance with IEEE 399, Chapter 6 using a static (positive-sequence) model.

**Load Analysis:** Include in each load summary a load growth factor of 20% or higher for future load growth.

**Fault Current:** Use IEEE 242 and IEEE 551. Extend calculations to address all areas spelled out NFPA 70E under Arc Flash study. A preliminary study should be performed at 100% CD design review

**Overcurrent Protective Device Coordination:** Use IEEE 241 and IEEE 242. Study will need to be performed in conjunction with Arch Flash study to achieve desired worker safety levels. Following approval of switchgear construction submittals, perform a final coordination study for the actual equipment to determine the final overcurrent protective device settings.

**Arc-Flash Hazard Analysis:** Use procedures and deliverable outlined in NFPA 70E and IEEE 1584. Further guidance and expected safety levels are listed below.

- Provide the final model back to Owner upon completion of project.
- Specify overcurrent protective device settings to achieve the required arc-flash results. Included a time over current coordination curve for each relay.
- Where possible, design the electrical system to limit arc-flash incident energy to a level that does not exceed Category 2 personal protective equipment (PPE).
  - Arc-flash hazard PPE categories are defined in NFPA 70E-2015, Table 130.7(C)(15)(A)(b).
- An areas where Category 2 cannot be achieved, use one of the following methods to reduce risk to personnel



- Upstream breaker
- Upstream current limiting fuse
- Differential relay (where proximity allows)
- Maintenance switch, include alarm when in maintenance mode.
- Arc resistant gear.
- Note: While On-board breaker controls, “Smart Gear”, a control umbilical, and a remote break control are excellent ways to reduce worker risk for breaker operations, it will not eliminate the arc hazard risk.
- Provide the final model back to Owner upon completion of project with record drawings.

### Equipment Ratings

Main Service should be designed on an infinite bus for Fault ratings. Minimum fault ratings should be 10,000A RMS symmetrical for 100V-250V and 14,000A RMS symmetrical; minimum 251V-1000V.

Do not use series rated equipment.

Unless otherwise required by code, use a solidly grounded, 480Y/277V, 3-phase, 4-wire service and distribution system. Specify a 208Y/120V, 3-phase, 4-wire service only if justifiable by a LCCA comparison to a 480V system. Load voltages should generally be as follows:

- Connect major 3-phase motor and power loads at the service line-to-line voltage.
- Connect large to moderate lighting loads at the service line-to-neutral voltage.
- Connect 120V receptacles, small general loads, and 208V single-phase and 3-phase equipment to separately-derived 208/Y120V systems using dry-type transformers if the service is 480Y/277V.
- Control voltages should match current campus facilities and be below 120V.
- Provide correct equipment for voltage. Do not correct equipment voltage level using an auto or buck boost transformer.
- Where equipment is capable, specify equipment to have a voltage range or multiple voltage taps.
- Where high single phase or high harmonic loads are present, size neutral bus and/or cable accordingly

Provide for future expansion

- Provide minimum 20% spare capacity (ampacity or VA) on all transformers feeder circuits and bus equipment (i.e. Panelboards, Switch Gear)
- For LV equipment provide minimum 10% spare breakers across Facility.
- For Switchgear and Switchboards provide one “equipped space” per bus.
- For Panelboards provide 10% spare Space.
- Minimum spare 20% spare raceway capacity. Cannot include remainder of % Fill on conduits less than 2”

## Power Quality and System Reliability

Separate loads as a minimum into HVAC, Lighting, Receptacle, Lab/Health/Sensitive Equipment (when applicable).

Using IEEE 519, provide adequate passive or active filtering to keep total harmonic distortion below 5% while on normal power and 10% on high harmonic. Point of common coupling shall be main breaker. Uses a correct K-Rated transformers for all such instances.

Provide a power-factor correction system (PFCS) for buildings where the service entrance equipment is rated 1200A or higher and the uncorrected average power factor of the system is expected to be below 0.95. Target the corrected power factor to be 0.95 (except for TAMU College Station, which is 0.97). Specify an automatically-controlled capacitor bank type PFCS where the VAR rating of the capacitors is less than or equal to 15% of the service transformer capacity (VA) rating or as recommended by the PFCS manufacturer.

## Standards for Material and Equipment

Use electrical materials and equipment that is constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized commercial standard. A complete current listing is published on <http://www.osha.gov/dts/otpc/nrtl/>. Where a piece of equipment is not labeled, listed, or recognized by any NRTL, provide a manufacturer's Certificate of Compliance indicating complete compliance of each item.

Do not install or use electrical equipment for any application other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by TAMUS.

- Use only Copper for all electrical Bus, grounding, interior wiring, and wires smaller than 1/0, for all other areas perform LCCA to determine materials.
- Include a main breaker on all switchgear, switchboards, panelboards, motor control centers and other similar equipment. (except for Sub-panelboards being feed from panel in same room)
- Where allowed by code and interrupt capacity, use circuit breakers.
- Arch-energy reduction employing zone-selective interlocking for switchgear and switchboards rated 1200A.
- For all equipment rated above 1200A or 1000V and for motors rated above 300A use electronic multifunction protective relay.
- Where equipment maintenance requires temperature readings from internal parts, include infrared viewing windows.
- When available used hinged doors over bolt on panels.

## Equipment Location and Layout

Locate electrical equipment:

- So it will be accessible for inspection, testing, service, repair, and replacement.
- So it can be removed without requiring disconnection of any other equipment, except that which is specifically connected to the piece of equipment
- Provide adequate space for ventilation and avoid stack heat producing electrical equipment. Provide a minimum of 6” unobstructed around such equipment.
- Avoid suspending electrical equipment (except necessary air handling equipment)

Locate generators so exhaust does not enter occupied spaces through outside air intakes. Provide a fire barrier constructed between the normal power supply (utility transformer) and emergency generator if both units are located within 20 feet. Do not use overhead power.

Do not install electrical equipment below piping or other means of liquid conveyance except where equipment is rated or a mechanical connections dictates location. i.e. Motor coupled with pump.

Pump rooms, including fire pump, shall be considered wet or damp locations, in terms of enclosures, raceways, and electrical devices. All electrical equipment including in line disconnects and controls necessary (etc.) for Fire Pump shall be rated NEMA 2 or above.

Provide means of replacing gear without the need of a crane for all Indoor Electrical equipment. Do not locate electrical distribution or control equipment in Stairways, Custodial closets, or Restrooms. Do not install transformers in open kitchens or cooking areas.

Show the minimum working clearances and dedicated equipment space around each electrical equipment on all drawings.

## Component Identification

Place an equipment code on the electrical symbols legend sheet that defines the nomenclature of all major electrical equipment specified for the project. Alternate component identification systems are acceptable but must include the following information:

- Location by building level, e.g. basement, first floor, penthouse
- Location by building area (if assigned by architect), e.g. A, B, C
- Power system class, e.g. normal, emergency, standby
- System voltage, e.g. 208/120V, 480/277V, 12.47kV
- Equipment type, e.g. switchgear, switchboard, transformer, panelboard
- A number at the end of the equipment designator to distinguish a specific equipment from other equipment of the same type, i.e. 1, 2, 3.

## Arc-Flash Hazard Warning Labels

Provide an Arc Flash warning label on all electrical equipment that contains a switching component. Label needs to be a minimum of 4"x6". Where equipment's incident energy level is equal to or less than 40 cal/cm<sup>2</sup>, provide an orange warning label. For equipment with incident energy level greater than 40 cal/cm<sup>2</sup> provide red danger label and include a label stating Discounting Device upstream.

## Circuit Identification

Provide a circuit directory for each switchboard, switchgear, and panelboard as described in NEC 408.4 and as follows:

- Upon final installation, place a neatly typed circuit directory using text no smaller than 1/8 inch high behind clear heat-resistant plastic in a metal frame door to the inside door of the equipment. Adhesive-mounted directory pockets are not acceptable.
- The directory shall contain all of the information contained in the panel schedule except load calculations, plus any field modifications.

Specify labels containing circuit number for receptacles in plants and laboratory areas and where requested by the user.

## Working Space Markers

In electrical rooms and areas where electrical equipment is located, permanently mark the floor with the NEC-required clear space in front of and behind switchgear, switchboards, transformers, panelboards, motor control centers, motor starters, and disconnect switches. Install marking on the floor using color schemes conforming to ANSI Z535.1 for black and white striped border.

## Equipment Foundations

Design concrete bases ("housekeeping pads") for indoor equipment to be not less than 4 inches high, and not less than 6 inches above grade for outdoor equipment. Extend floor pads to not less than 4 inches beyond the supported equipment in both directions. Specify foundations to be within manufacturer's tolerances.

Provide vibration isolating pads for transformers and other vibrating electrical equipment, if not integral to equipment.

## Electrical Demolition

Remove abandoned electrical distribution equipment, utilization equipment, outlets, and the accessible portions of wiring, raceway systems, and cables back to the source panelboard, switchboard, switchgear, telecommunications, or cabinet. Remove conduits, including those above accessible ceilings, to the point that building construction, earth, or paving covers them. Cut conduit beneath or flush with building construction or paving.

Plug, cap, or seal the remaining unused conduits. Install blank covers for abandoned boxes and enclosures not removed. Leave abandoned electrical equipment, conductors, and material in place only if one or more of the following conditions exist:

- The removal requires the demolition of other structures, finishes, or equipment that is still in use. An example is abandoned conduit above an existing plaster ceiling.
- Removal of abandoned conductors may damage conductors that must remain operational.

Extend existing equipment connections using materials and methods compatible with the existing electrical installation and this Division. Restore the original fire rating of floors, walls, and ceilings after electrical demolition.

### Electrical Acceptance Testing

Perform electrical acceptance testing in accordance with the current edition of the International (National) Electrical Testing Association (NETA) “Acceptance Testing Specification ATS.”

### Medium-Voltage Service and Distribution

Permanent overhead distribution for medium-voltage and low-voltage systems is prohibited for new construction.

Unless noted otherwise in the project Program of Requirements (POR), any modifications necessary to extend or upgrade the campus utility distribution system to supply electrical service to a new project or project site must be fully funded by that project.

Contact the campus ODR or local utility provider to obtain utilization voltages, grounding, load connections, and fault current availability.

All medium-voltage conductors shall be installed in IMC, RMC, PVC, RTRC, or Cable Tray Only. Above grade installations shall be in rigid galvanized steel (RGS) conduit unless in a limited access industrial facility. For all underground installations see “Underground Raceways.”

The A/E shall design reliability and redundancy into medium voltage system on campus. This shall include the addition of extra Conduit, Cable, Manholes, and Switches or Switchgear, so as to complete (or make ready to complete) feed loops and/or secondary feeds.

IEEE 241, Subclause 4.8 for design guidance and information.

When applicable all medium voltage equipment shall include:

- Dead-front design with separable insulated-type connectors
- Full overcurrent protection
- SCADA interface (if required by user)
- Visual indication of switch, contact, or breaker status

- A concrete foundation.
  - With vault where connections are made in close proximity to base. i.e. Padmount switches and Padmount transformers
  - Equipment Pad must be checked for Level to Manufacture tolerances before equipment is set.
- Low profile enclosure (if available)
- Provide bollards, curbs, or other structures to keep vehicles out of the required working space, when in proximity of vehicles' path.
- Spare set of fuses
- Torque mark is on all bus connections

### Medium-Voltage Switches

#### Medium Voltage Pad Mounted Switch

Applicable Standards: IEEE C37.60, IEEE C37.74, and IEEE C57.12.28.

Switch Provisions:

- Copper busing
- Type 304 stainless steel welded tank construction
- Liquid- or solid-dielectric, vacuum, or SF<sub>6</sub> gas insulating/interrupting medium
- If not found elsewhere on campus, provide minimum one spare breaker of largest size.
- Locate switch to permit adequate maintenance access. Allow 10 feet of clear working space in front of the switch enclosure doors for the full width of the enclosure.

#### Metal-Enclosed Interrupter Switchgear

Applicable Standards: IEEE C37.20.3 and IEEE C37.46

Switchgear Provisions:

- Current-limiting E-rated power fuses
- Weatherproof enclosure for outdoor locations

#### Metal-Clad Switchgear

Applicable Standards: IEEE C37.20.2, IEEE C37.04, IEEE C37.06, IEEE C37.09, and IEEE C37.90.

Switchgear Provisions:

- Vacuum circuit breakers
- Protective relaying system
- SCADA interface with Local/Remote lock out.
- All controls shall be wired out to relay.
- Walk-in aisle-type weatherproof enclosures for outdoor locations
- Ventilation and air-conditioning for outdoor switchgear as may be necessary to ensure that interior temperature does not exceed manufacturer's recommendations.

### Submersible Switchgear

Applicable Standards: IEEE C37.74, IEEE 386, IEEE 592, IEC 60265, and IEEE C37.60

Specify fully submersible switchgear as follows:

- Fault-interrupter devices
- Enclosure suitable for flooded and corrosive conditions
- SCADA interface (if required by user)
- Type 304 stainless steel welded tank construction
- Vacuum insulating/interrupting medium, \*do not specify Oil filled or SF6

### **Medium-Voltage Transformers**

Specify oil-filled pad mounted medium-voltage transformers for outdoor locations and dry-type transformers for indoor locations. Specify medium-voltage transformers to comply with the minimum efficiency requirements of [10 CFR 431.196 \(DOE 2016\)](#).

Install indoor and outdoor transformers according to NFPA.

Provide transformer primary overcurrent protection in accordance with IEEE 242.

Surge Protection shall be primary distribution-class metal-oxide type surge arresters according to in accordance with IEEE C62.22, or as recommended by the arrester manufacturer.

Specifications for Medium-Voltage Transformer and Transformer capacity should comply with Texas A&M University's Utility Energy Services' standard [Medium Voltage Power Systems](#) Part 7 unless individual campus has its own standard.

Outdoor transformers shall be located per the requirements as follows:

- Locate transformers per table 26.1
- Additional separation may be required for transformers located near windows, doors, ventilation louvers, or other similar openings.
- Locate transformers so that terrain or other structures will protect it from accidental contact by vehicles, or provide suitable protective barriers.
- Provide adequate access on all sides of each transformer for maintenance and replacement in accordance with the campus facilities/utilities maintenance department and the manufacturer's requirements. Allow a minimum of 10 feet clearance in front of the enclosure doors.
- Provide and maintain an 18-foot wide all-weather access path so a utility digger derrick truck can drive up next to at least one side of each transformer; landscaping shall not restrict this access.
- Locate transformers where no piping or conduit, except that connected to the transformer, passes beneath the transformer pad.
- Locate transformers so that drainage is away from the building, or design a

containment or diverter for the oil as may be required by TAMUS/TAMU Environmental, Health & Safety.

Indoor Dry type transformers shall be located as follows:

- Specify the transformer and associated switchgear as integral components of a unit-type substation.
- Locate a minimum of 36 inches from interior building walls.
- Electrical Room containing transformer shall have ionization type smoke detectors and automatic sprinkler protection.
- Electrical Room containing transformer shall have mechanical cooling or ventilation powered from a reliable source (emergency or standby power) to maintain transformer vaults or rooms within temperature limits appropriate for transformer operation.

Transformer Fluid Type	Fluid Volume, gal	2-hour fire-rated wall, ft	Non-Combustible, ft	Combustible Wall, ft
High Temperature Esters	≤10,000	5 + Containment		25 + Containment
	>10,000	15 + Containment		50 + Containment
Mineral Oil or Equivalent Flashpoint	<500	5 + Containment	15 + Containment	25 + Containment
	≤5,000	15 + Containment	25 + Containment	50 + Containment
	>5,000	25 + Containment	50 + Containment	100 + Containment
Design Containment per IEEE 980 Ch7. Minimum containment shall extend 5 feet from fluid-containing components.				

**Medium-Voltage Cable**

Comply with ANSI/NEMA/ICEA S-93-639/NEMA WC-74, the NEC, IEEE 576, IEEE C2, and UL 1072 for medium-voltage power cable components materials, installation, and testing.

Specifications for Medium-Voltage Cable shall comply with Texas A&M University’s Utility Energy Services’ standard [Medium Voltage Power Systems](#) Part 1 unless individual campus has its own standard.

Where cables ties into existing cable, new cable shall match old cable until next termination.

**Medium-Voltage Cable Terminations and Splices**

- Do not splice medium-voltage cables without written authorization by TAMUS.
- Specify terminating materials and ratings that are compatible with the cable supplied.
- Submit electrician’s cable splicing and terminating qualifications and certifications to TAMUS prior to performance of the work. See TAMU UES’s standards for qualifications. [Cable Splicing & Termination Qualifications](#)



### Medium-Voltage Separable Connectors

- Connector system components shall comply with IEEE 386.
- Pre-molded ethylene propylene diene monomer (EPDM)-type, submersible, fully shielded, separable insulated connectors for use with MV-105 power cable as specified above.
- Specify 200A-rated load-break elbow connectors for outdoor terminations at medium-voltage transformers and switchgear with switch-ways rated at 200A continuous.
- Specify 600A-rated dead-break Tee body connectors for terminations at medium-voltage switchgear with switch-ways rated at 600A continuous.
- Do not use separable connectors to splice cables. Except in Junction Boxes above ground.

### Medium-Voltage Non-Separable Terminations

Terminate shielded medium-voltage cables using cable terminators that meet Class 1A requirements of IEEE 48.

- Indoor Terminators: Silicone rubber, cold shrink, tubular or skirted.
- Outdoor Terminator: Silicone rubber, cold shrink, skirted.
- Acceptable Manufacturers: Elastimold, RTE, 3M

### **Medium-Voltage Cable Testing**

#### Factory Tests

The cable manufacturer shall perform non-destructive factory tests on all medium-voltage conductors in accordance with ICEA, NETA ATS, and IEEE standards and shall furnish certified test reports to TAMUS.

#### Contractor Responsibilities

- Field-test cables prior to energization, and verify with Factory Test reports.
- During construction (typically during the Acceptance Testing phase), notify TAMUS 14 days in advance of the time that the cables will be ready for field testing. This will allow time for TAMUS to contract the services of a certified cable-testing firm to conduct the tests described below.
- Complete the TAMUS Medium-Voltage Cable Testing Information Form 26A-2.1 in Appendix A and submit to TAMUS 14 days prior to testing date. TAMUS will provide the completed form to the cable testing firm.
- Cooperate with and give all necessary assistance to this firm while the tests are conducted.
- Provide means to ensure safety during the tests.
- If a cable fails any of the required testing, remove all cables in the conduit between the nearest pulling points on each side of the failure. If, in the opinion of TAMUS, the other cables in the same conduit have not been damaged, they may be reinstalled, but

the cable which failed shall be replaced with a new and unused cable. After the faulted cable and any other damaged cables have been replaced and installed, re-test all cables in the faulted section or circuit at the same voltage levels and durations as the original test.

- During the period of warranty, any failure in medium-voltage cable, terminations, or splices shall require immediate correction. In the event of a cable failure creating interruption in electrical service, furnish and install all labor and materials for temporary services to return the electrical system to service. Work shall begin immediately upon notification of a failure, regardless of time. TAMUS will not pay any costs associated with a cable failure.

### Testing Firm Responsibilities:

Perform full test report on all cables and terminations (non-destructive). Compare results to factory test reports, reject any cable not within margins set forth by manufacture. When factory does not provide test reports, or when campus require preform a “proof test” (High-Voltage Withstand Test – Destructive). Use the appropriate voltage and durations in accordance with IEEE 576-2000 and the cable manufacturer’s recommendations.

## Low-Voltage Service and Distribution

Convert existing facilities with ungrounded service systems to solidly grounded service systems during major renovations or service equipment replacements.

Note: The service point, as defined in the NEC, is at the secondary terminals for the utility transformer for projects served by TAMU Utilities and Energy Services. For other projects and TAMUS campuses, the service point varies depending on the utility service provider.

## Building Service

Electrical service shall be run in a manner so that the “Conductors Considered Outside the Building” (NEC 230.6) up to the Service equipment disconnect. Service equipment disconnect shall be a 100%-rated, single, main circuit breaker integral to the service equipment.

- Do not splice service conductors between normal and emergency/standby power supplies (e.g. utility transformers and generators) and the service or power transfer equipment.

All facilities require a main electrical meter, refer to the online TAMU UES Design Standards for additional metering requirements.

- Important: Contact TAMU/UES for meter selection specific to each project or installation.
- All meters shall be a digital meter, with a display and communication. Communications shall be compatible across all meters and with any local SCADA system.
- Provide an Ethernet data port at the main-meter location for connection to the UES

- power metering LAN.
- TAMU UES’ “WAGES” panel shall be furnished and installed by the electrical contractor under Division 26.

### Low-Voltage Surge Protection

Provide permanently-installed surge protection for electrical power systems, control circuits, communications systems (including but not limited to CATV, alarm, and data circuits), and antenna systems entering and exiting all buildings and other structures, including buildings and structures that may not have lightning protection on the roof.

Specify UL 1449 4<sup>th</sup> edition, permanently-connected, hard-wired type surge protective devices (SPDs) for low-voltage service and distribution equipment in accordance with IEEE 1100, NFPA 780, NEC 285, and NEC 700.8. Show all SPDs on the one-line diagram down to the branch-circuit panelboards.

- Provide surge protection for all low-voltage building services; connect a Type 1 or Type 2 SPD to the main bus of the service equipment on the load side of the main breaker.
- Install SPDs outside the enclosures of panelboards and switchboards; however, SPDs may be installed in separate compartments of a switchgear assembly (UL 1558) if supplied by a dedicated circuit breaker.
- Specify visual indication that the unit has malfunctioned or requires replacement. Provide Form C dry contacts in the SPD and extend wiring to the building automation system for remote monitoring.
- Specify not less than a 5-year warranty and include unlimited free replacements of the unit if destroyed by lightning or other transients during the warranty period.

### Low-Voltage Switchgear

Design metal-enclosed low-voltage power circuit breaker switchgear per IEEE C37.20.1, NEMA SG-5, and UL 1558.

- Specify electrically-operated, individually-mounted draw-out type circuit breakers.
- The switchgear and circuit breakers shall be the product of the same manufacturer.
- Switchgear shall be fully accessible from the front and rear.

### Low-Voltage Switchboards

Design switchboards in accordance with NEMA PB2 and UL 891.

- Specify switchboard assemblies to be front- and rear-aligned.
- Devices shall be completely isolated between sections by vertical steel barriers.

### Low-Voltage Panelboards

Design panelboards in accordance with NEMA PB1 and UL 67.

- Panelboard enclosures shall be wall-mount type.
- Specify Type 304 or 316 stainless steel covers for panelboards located in open kitchens,

- cooking areas, and wash-down areas.
- Specify panelboards with bolt-on breakers; load center-style panelboards and plug-in type breakers are not permitted.
- Do not specify sub-feed breakers.
- Do not use panel boards for service entrance equipment unless service is rated for less than 800A
- If ground-fault protection is required for the service disconnecting means on 480/277V services, provide an additional step of ground-fault protection in the next level of feeders.
- Do not use series-combination-rated circuit breakers, tandem circuit breakers, Stab-on breakers, and/or feed-through (“sub-feed”) breakers.
- Breakers 400A and above shall be 100% continuous current rated, with electronic strip (shunt trip) and LSIG. Breakers shall also be identify on the one-line diagram.
- Use common-trip type 2- and 3-pole breakers so that an overload or fault on one pole will trip all poles simultaneously; handle ties are not acceptable.

### Low-Voltage Motor Controllers & Motor Control Center

Use source transformer or generator performance curve as well as motor starting curve to determine if a reduce voltage starter, soft start or VFD is required.

- Provide controllers having a UL 508 short-circuit withstand rating that exceeds the fault current available
- Provide color-coded and labeled LED type indicator lights on the front of each magnetic controller.
- Provide start-stop switch function on the front of each magnetic controller not connected to automatic controls. Arrange control circuit to include emergency stop functions, such as fire alarm interlocks.
- Specify selector switches on motor controllers for the purposes of testing or manually controlling the equipment.
- Use solid-state motor starter overloads.
- Except for packaged equipment with integral controllers, do not locate motor controllers above ceilings.

### Low-Voltage Dry-Type Distribution Transformers

Specify low-voltage transformers to comply with the efficiency requirements of [10 CFR 431.196 \(DOE 2016\)](#). For additional sizing and ratings see IEEE C57.96 IEEE 1100, IEEE 519, IEEE C57.110, and UL 1561.

- Limit the capacity rating of each low-voltage transformer to 112.5 kVA or less.
- Do not use step-up, auto transformers or field-installed “buck-boost” transformers.
- Do not locate 3-phase dry-type transformers supplying building loads outdoors.
- Design the installation such that transformer vibrations are not transmitted to the surrounding structure or where sound level is not increased by sound reflection. Use flexible couplings and conduit to minimize transmission through the connection points.

- Bond the transformer secondary neutral ( $X_0$ ) directly to the grounding electrode by means of a listed bonding kit.

### Low-Voltage Electric Motors

Motors are typically furnished and installed under the division that specifies the component or system they are associated with, with electrical connections by Division 26.

Use the following guidance in selecting motor-rated voltages:

- 200/208V, 230V, or 460V, 3-phase, 60 Hz for motors 1/2 HP and larger; match building secondary service voltage.
- 460V, 3-phase for motors 25 HP and larger.
- 4,160V, 3-phase for motors 500 HP and larger.
- 120V, 277V, or 200/208V, single-phase, 60 Hertz for motors smaller than 1/2 HP.

### Low-Voltage Variable-Frequency Drives

Variable-frequency drives (VFDs) shall Comply with IEEE 519, IEEE C37.96, and NEMA ICS 7.0 in the selection of VFDs. In addition to this section, refer to [UFC 3-520-01, Appendix B “Adjustable Speed Drives”](#) for additional design guidance on the use of VFDs. For Specific application see the [NIH Design Requirements Manual](#).

- Contactor bypass option, or Spare VFD per size on project.
- Overcurrent protection.
- BACnet communications capability for interface with building automation system.
- Shaft grounding rings (SGRs) or common-mode filters to eliminate high frequency damage to motor bearings.
- Minimum 6-pulse width modulation (PWM) design.
- Provide VFD-rated cable between the VFD and the motor supplied.
- Where a disconnect switch exists between VFD and Motor, provide an interlock scheme to prevent damage to VFD.

### Low-Voltage Receptacles

Determine final receptacle types, ratings, NEMA configuration, and quantities as per user and code requirements.

- Do not connect more than 5 single duplex receptacle (or equivalent) per 20A breaker.
- For receptacles that are automatically controlled, comply with ANSI/ASHRAE 90.1 8.4.2
- Specify emergency-powered receptacles with red colored faceplates engraved with 0.25-inch white letters to read “EMERGENCY.”
- Specify metallic weatherproof covers for receptacles located outdoors.
- Insure duty rating and housing of receptacle match permanently installed equipment.
- If required, provide 120V, 20A isolated-ground grounding-type receptacle outlets for electronic equipment.
- Quantity and locations (120V):
  - All rooms shall have a minimum of one outlet, and entire facility shall have an

- outlet with in at least 20 feet from any one location.
- All general offices, labs, small –medium classrooms rooms, and areas designated for study, should have a receptacle with in 6ft from any point and at least one per wall.
- Rooms with computer or small equipment should include at least one outlet per expected computer/small equipment. Single person offices should have at least two walls with two (duplex) receptacles each.
- Provide receptacle (480V 3-wire) outlets for electric welders in mechanical equipment rooms, and other areas where future repairs may warrant. (where applicable design to use no more than one (1) 50ft extension cable,)

### Low-Voltage Branch-Circuit Wiring Devices

- All devices shall be specification-grade and rated at 20A minimum.
- Specify stainless steel device plates in laboratory spaces; nonmetallic plates, if used, shall be nylon. Coordinate style selections with architect.
- Group power and communications outlets and light switches in a symmetrical fashion.
- Show all wiring devices on the design drawings and any changes on the as-built drawings.
- Do not place outlet boxes back to back; provide at least 12 inches of separation between outlet boxes located on opposite sides on common walls.
- Avoid Placing receptacle and lights under windows.

### Low-Voltage Power Conductors

Calculate the ampacity of low-voltage power conductors installed in parallel underground ducts within the same trench or concrete envelope in accordance with NEC 310.15, IEEE 835, IEEE 399, or approved software.

Use IEEE 241 and ANSI 90.1 for Voltage drop calculation and standards.

Identify all power wiring system conductors (phase, grounded (neutral), and grounding conductors) at each accessible location using color-coding that is consistent throughout the building. Refer to Table 26.2 for standard color-coding of wiring according to system operating voltage level and number of phases.

**TABLE 26.2: COLOR CODE FOR LOW-VOLTAGE POWER CONDUCTORS**

CONDUCTOR	240 / 120V	208 / 120V	480 / 277V
PHASE A	BLACK	BLACK	BROWN
PHASE B	RED	RED	PURPLE
PHASE C	N/A	BLUE	YELLOW
NEUTRAL	WHITE	WHITE	GRAY
EQUIPMENT GROUND	GREEN	GREEN	GREEN
ISOLATED GROUND	N/A	GREEN /YELLOW	N/A
SWITCHED LEG	PINK	PINK	PINK
HIGH LEG (prohibited for new insulation)	N/A	ORANGE	N/A

### Low-Voltage Building Wire and Cable

All conductors shall be soft-drawn annealed copper class B, C, or D stranded. Specify as follows:

- General power and lighting: Minimum size #12 AWG; solid conductors for #12 AWG and #10 AWG and stranded conductors for #8 AWG and larger.
- Stranded conductors for connections to motors, generators, and other vibrating equipment (all sizes).
- Control (field-installed): Minimum size #14 AWG; stranded conductors all sizes.

Specify 600V Type XHHW-2 insulated copper conductors where installed outdoors above and below grade. Note: The NEC does not require temperature ampacity adjustment for Type XHHW-2 insulated conductors.

Install building wire and cable as follows:

- Do not install building wiring, equipment, and devices that are listed for dry/indoor locations-only until the building is dried-in.
- Do not use multiwire branch circuits. Provide a dedicated grounded (neutral) conductor for each branch circuit that requires a neutral.
- Do not direct bury conductors; install all underground conductors in conduits.
- Metal-Clad Cable or MC Cable may be used for light switches and receptacles whips of no more than 25 ft and as follows :
  - Only in general occupancy rooms, such as offices, classrooms and conference rooms. Do not use in Rooms such as Mechanical Rooms, Electrical Rooms, Laboratories, or any other high equipment rooms or laboratories.
  - MC Cable must be installed to a minimum of NECA standards, additionally must be installed in straight runs with definite bends only and must be well secured. Well secured shall be no more than 1” deflection for straight runs and 3” of deflection for bends at 3 lbs. of force.

### Low-Voltage Raceway Systems

Specify raceway systems to contain low-voltage service, feeder, and premises branch-circuit wiring systems. Maintain minimum separations between power levels as described in IEEE 518.

Raceways, boxes and fittings used under raised floors (e.g., computer rooms, server rooms) must have low flame spread, low smoke, and zero halogen characteristics determined in accordance with ASTM E 162, ASTM E 662, or Bombardier SMP-800C, *Toxic Gas Generation*.

Do not route raceways or cable of any type horizontally in walls or partitions except for receptacles located below windows. Where ever possible do not install electrical equipment below windows.

Unless otherwise specified do not apply spray-on or other types of insulating material on the outside of conduits and other raceways installed above ceilings.

### Raceways and Fittings

For below grade Raceways see Underground Raceways.

- Do not specify nonmetallic conduit or tubing above grade in indoor or outdoor locations except for grounding electrode conductors where permitted by NEC.
- Do not exceed 270° between pull points.
- For electrical Power do not use trade conduit size less than 3/4 inch. For control wiring do not use trade conduit sizes less than 1/2 inch.
- Use IMC or RMC where subject to major physical damage, such as that done by a vehicle.
- Where floor boxes are used on the first floor, specify corrosion-resistant cast-in-place type.
- Seal entries into floor boxes and “poke-through” fittings installed over unconditioned spaces by a means approved by TAMUS.
- Install a nylon pull rope with not less than 200 pounds tensile strength in all empty conduit runs.
- Connections to luminaires (fixture whips): 1/2-inch flexible metal conduit may be used in 6-foot maximum lengths for tap conductors to luminaires above accessible suspended ceilings.
- Only use ARC, RTRC, corrosive resistant RMC, or corrosive resistant IMC in cooling towers, or in other corrosive environments
  - Where polyvinyl chloride (PVC) coating is used for supplementary protection, it shall consist of a minimum of 20 mils thick, 2-inch wide field-applied PVC tape wrap, or 40 mils thick factory-applied PVC coating.
- Do not use PVC above grade unless specified. General exception for crawl spaces.
- Do not mix PVC schedule 40 and 80.
- Use FMC or LFMC for connections to vibrating or moving equipment such as motors and transformers. Minimum length shall be 18 inches, maximum length 72 inches.
- Do not use Set-screw fittings.
- All conduits shall be marked by color code at minimum before each box and before and after any poke through.
  - Mark shall be minimum 3/8 inch band that completely wraps conduit and shall comply with color code in Table 2.



Electrical Boxes

Use all ANSI and NEMA standards for electrical boxes. Also include the provision that follow:

- Masonry Boxes shall be galvanized
- Boxes larger than 4”x4” located outdoors and below grade shall be rated NEMA 4 at minimum.
- All junction and Pull Box Covers shall be labeled.
  - Label shall include all Circuits contained within box as well as Panel and breaker number.
- Boxes and Box Covers shall be painted to match color code in Table 26.3, unless excluded for aesthetic purposes.

**TABLE 26.3: COLOR CODE FOR BOXES**

SYSTEM	CONDUIT BAND COLOR	BOX COVER	
		IDENTIFICATION	COLOR
FIRE ALARM	RED	FA	RED
EMERGENCY POWER (ALL VOLTAGES)	WHITE	EM / PANEL ID / CKT. NO.	WHITE
208/120V NORMAL POWER	BLUE	PANEL ID / CKT. NO.	BLUE
480/277V NORMAL POWER	YELLOW	PANEL ID / CKT. NO.	YELLOW
DATA, TELECOM, FIBER OPTIC, AV	ORANGE	DATA, TELE, FIBER OPTIC, AV	ORANGE
HVAC CONTROLS	GREEN	HVAC	GREEN
SECURITY	PURPLE	SEC	PURPLE

**Interior and Exterior Lighting**

Specify an LED light source for all interior and exterior lighting. Alternative light sources may be considered for special indoor use only.

Design lighting systems according to the latest editions of:

- [ANSI/IES Recommended Practice \(RP\) Standards for Lighting](#)
- ANSI/IESNA The Lighting Handbook, latest edition
- ANSI/ASHRAE/IESNA Standard 90.1 or IECC

Perform lighting calculations using appropriate procedures as outlined in the IES or IESNA Lighting Handbook.

Refer to [TAMU UES Design Standards](#) for indoor and lighting requirements as applicable to the various TAMUS campuses.

The lighting standards used at the main campus in College Station campus are not the same standards used at other TAMUS campuses. Contact TAMUS Owner’s Designated Representative facilities management staff for the current campus-specific lighting standards at the individual TAMUS campus.

### Controls for Interior Lighting

Adjust time-out settings for occupancy sensors to optimize energy saving, relamping cost, and customer satisfaction. The following optimal settings have been determined:

- Classrooms, private offices, open offices, laboratories, and restrooms: longest time-out setting, but not more than 30 minutes.
- Break rooms, storage rooms, copy machine rooms: 5-minute time-out setting
- Conference rooms: 10-minute time-out setting
- Corridors, lobbies: 15-minute time-out setting

In corridors design un-switched “night lighting” luminaires at the entrance/exit to the corridor and at major corridor intersections. Night lighting luminaires may also be part of the emergency lighting system described below. In spaces with more than one personnel entrance, design the lighting controls so any required manual control will be available at each entrance.

### Emergency Lighting Unit Equipment

Use emergency lighting unit equipment that is UL 924 listed and labeled for the intended use.

- In finished spaces of office and laboratory spaces, use emergency battery/inverter units with a self-test feature.
- For typical service and industrial spaces, use wall-mounted, receptacle- connected lighting unit equipment with a self-test feature. Install a dedicated receptacle adjacent to each emergency lighting unit.
- Certain locations in special facilities may have environments or other conditions that require special emergency lighting unit equipment suitable for the application.
- Where commercially available, use emergency lighting units that automatically perform a self-test of battery and lamps for not less than 30 seconds every 30 days and have a visual status indicator to indicate any failure.
- Connect emergency lighting unit equipment to the branch circuit serving normal lighting in the area and ahead of any local switches. In lighting panelboards, clearly identify the branch circuits that serve unit emergency lighting equipment.

### Emergency Exit Signs

- Where practical, use LED emergency exit signs that are UL 924 listed and labeled for the intended use and meet EPA “Energy Star” standards.
- Specify exit signs with green LED lamps.
- New and replacement emergency exit signs shall automatically perform a self-test of battery and lamps for not less than 30 seconds every 30 days; a visual status indicator shall indicate any failure. Units shall also perform tests that are manually initiated by a test button.
- Connect emergency exit signs to the branch circuit serving normal lighting in the area and ahead of any local switches. In lighting panelboards, clearly identify the branch circuits that serve emergency exit signs.

**Exterior Building Lighting**

Outdoor light shall comply with “dark skies” requirements published by the State of Texas in its [Health and Safety Code, Chapter 425, Regulation of Certain Outdoor Lighting](#). The International Dark Sky Association "Lighting Code Handbook" provides useful design guidance.

**Exterior Luminaire Selection**

Design building-mounted safety and security lighting for exterior doors, stairways, loading docks, and mechanical equipment yards, plus parking lots and pedestrian walkways located adjacent to the building.

Select exterior lighting systems following guidance in the IESNA Lighting Handbook. Minimize the number of lamp and ballast types.

**Controls for Exterior Lighting**

Design exterior lighting controls that comply with energy code requirements applicable to the project.

Control exterior lighting to be on at dusk and off at dawn by means of a photocells and time clock combination through a HAND-OFF-AUTO selector switch and lighting contactor; where HAND bypasses photocell.

**Exterior Illumination Levels**

Design to the illumination levels in Table 26.4 below unless directed otherwise by TAMUS.

**TABLE 26.4– ILLUMINATION LEVELS**

Location	Min. Horiz. Footcandles	Avg. Horiz. Footcandles	Min. Vert. Footcandles	Avg. Vert. Footcandles	Uniformity Ratio
Pedestrian Ways	1.0	-	0.1	2.2	-
Parking Lots	1.0	-	0.1	2.2	-
Roadways:					
Major	-	1.2	-	-	3:1
Collector	-	0.8	-	-	4:1
Local	-	0.6	-	-	6:1

**Backup and Alternative Power**

Energy sources that may be used to supply backup power to TAMUS building and facility loads in the event that the primary (utility or normal) power source fails include on-site engine-generator systems (EGSs), central battery systems, and uninterruptible power supply systems.

Identify all loads connected to backup power sources (generators, battery systems, UPSs, etc.) in the load analysis summary including NEC power class associated with each load type (Emergency, legally required standby, optional standby, COPS, etc.). The terms “emergency system,” “legally required standby system,” and “optional standby system” used in this section are the same as the terms defined in NEC 700, 701, and 702, respectively.

Multiple methods exist to supply EPSS to any facility’s use LCCA to most cost effective option, include all maintains cost.

Other than an EGS locate all other EPSS systems in a fire rated Emergency Electrical room.

### Engine-Generator System

Size the EGS to supply all of the connected loads simultaneously, starting connected motor loads, and providing not less than 20 percent future load growth.

- If the EGS will be an alternate supply to variable frequency drives or similar harmonic-generating loads exceeding 25 percent of the EGS nameplate rating, assure that the non-linear loads can operate successfully when powered by the EGS.
- If the EGS will be an alternate supply to elevator loads exceeding 25 percent of the EGS nameplate rating, ensure that elevator controller has provisions to absorb regenerative power. Coordinate EGS selection and provisions with elevator and EGS manufacturers.

Coordinate the EGS electrical design with the mechanical and architectural design. Diesel EGSs shall be located outdoors and on grade, preferably within the same service yard as the utility (normal supply) transformer, with a fire barrier separating the EGS from the transformer as described under “Outdoor Equipment”. Allow adequate clearances for operations and maintenance.

EGSs may be designed to operate in parallel with the local utility.

Refer to [TAMU UES Design Standards](#) for specifications and other requirements for diesel EGSs, load banks, and automatic transfer switches. Note For other campuses and Main campus not Fire and Life EPSSs natural gas, and propane are permitted as energy sources for emergency EGSs.

Specify that all malfunctions of EGS be transmitted to the building automation system (BAS). Provide a contact for the EGS output breaker to be connected to the BAS, indicating output breaker position, to allow annunciation of the open position on the BAS.

Provide maintenance and operational testing of the EGS, including all EPSS equipment, in accordance with NFPA 110, Chapter 8. Perform all load tests using the load bank furnished with the EGS.

### Legally Required Stand by Systems

Specify a minimum Class 24 emergency power supply system (EPSS) to supply building loads, where 24 is the minimum time in hours for which the EPSS is designed to operate at its rated load without being refueled (see NFPA 110, Chapter 4).

Specify a Type 10 EPSS, where 10 is the maximum time in seconds that the EPSS will permit the load terminals of the transfer switch to be less than 90 percent of the rated voltage (see NFPA 110, Chapter 4).

### Optional Standby System

For facilities that have an NEC classified Optional Standby System; specify transfer of power from normal to on-site generated power in no less than 60 seconds of normal power failure. Note: Unless disallowed by code, the same transfer scheme may be used to supply both legally required and optional standby loads.

### **Automatic Transfer Switches**

Automatic Transfer Switches (ATSs) shall be listed in accordance with UL 1008 and shall include:

- In-phase monitoring and pre-transfer contacts for all ATSs supplying motor loads
- An integral isolation bypass switch to ATSs used for emergency (life safety) and legally required standby applications.
- A 4-pole switch when a connected EGS is a separately-derived system (see NEC)

### **Central Battery System**

Design, install, and test the Central Battery Systems (CBSs) in accordance with IEEE 446, NFPA 70, NFPA 101, NFPA 111, and UL 924. CBSs shall:

- Comply with the requirements for a Level 1, Type 10 stored-energy.
- Be design for a minimum time of 90 minutes
- Use nickel–cadmium or lead-calcium batteries with a minimum 20-year design life.
- Be sized with proper de-rating based on ambient temperature, altitude, and design life.
- Include an external bypass maintenance switch, to connect load directly to Normal power
- Be designed not to have any exposed live parts.
- Be designed with a safe means of testing and maintenance, per NFPA 111

### **Uninterruptible Power Supply Systems - (Non-EPSS)**

Evaluate requirements for Uninterruptible Power Supply (UPS) systems on a case-by-case basis. If a UPS is required, it may or may not require generator backup. Provide sufficient battery capacity to accomplish an orderly shutdown of UPS loads when generator backup is unnecessary.

If the nature, magnitude, and locations of critical loads to be supplied by the UPS is not identified in the POR, the A/E shall determine these requirements during the Design Development phase of the project.

Design, install, and test UPS systems in accordance with IEEE 446, IEEE 493, IEEE 944, IEEE 1100, NFPA 70, NFPA 111, NEMA PE 1, and UL 1778.

Addition design requirements:

- Determine UPS type by listed requirements as well as a LCCA based on a 20-year life.
  - Include initial cost in both hardware and floor space and maintenance cost for both unit maintenance and condition space requirements.
- Do not supply AC motors from a static type UPS system; specify a rotary or flywheel type UPS or use DC motors supplied directly from static source.
- If UPS connects to an EGS as a load, limit UPS recharge while on Emergency power.
- If UPS is backed up by an EGS, to provide for continuous operation, specify the EGS to supply all necessary auxiliary UPS equipment, i.e., the lighting, ventilation, and air-conditioning.
- Size the UPS system with spare capacity of at least 25% (amp-hour) in stored energy and 10% in supplied power (kVA).
- Specify a redundant UPS module depending on the criticality of the supplied loads.
- IF UPS is of a battery type use nickel–cadmium or lead-calcium batteries
- Be design not to have any exposed live parts and with a safe means of testing and maintenance.
- Provide both a local and a remote system status and alarm panel, with both audio and visual status/alarms. Specify that all alarms be transmitted to the building automation system (BAS). Include status /alarms, as a minimum:
  - System on
  - System bypassed
  - System fault
  - Out-of-phase utility/line fault
  - Closed generator output breaker
  - Audible alarm and alarm silencer button

Locate UPS systems as follows:

- UPSs used as part of EPSS may be located in the Emergency Electrical Room.
- For UPS systems over 100 kVA and of a battery type, provide rack-mount batteries in a dedicated battery room with in accordance with applicable codes.
- For UPS systems rated over 15 kVA and of a battery type, batteries shall be separate from charger and inverter.
- UPS room shall:
  - Isolate noise of UPS
  - Will be an unoccupied space for UPS systems louder than 60dBA
  - Maintain a temperature of based on Manufacture specification at all times.
  - Be provided with a minimum 30% efficiency air filtration.
  - Include necessary fire and personnel safety equipment.

- Include an area for all Spare parts and maintenance equipment.

### Renewable Energy Sources

Renewable electrical energy source (RES) technologies that may be considered for use at TAMUS campuses presently include photovoltaics (solar), wind turbine generators (wind), and hydropower.

Any user request for such systems shall require the A/E to justify implementation by performing a LCCA comparison to that part of the building electrical system that otherwise be used as a source of normal (utility) power. A payback period of more than 10 years for any RES system shall not be considered cost effective.

Refer to Section A, “Sustainability & Energy Performance” for general information.

Refer to [Unified Facilities Criteria UFC 3-540-08, Utility-Scale Renewable Energy Systems](#), Chapter 2, “Planning and Development” for general design criteria and guidance that may be used for the LCCA evaluation.

### Underground Raceways

Medium voltage (MV) and low voltage (LV) service and feeders shall be installed in reinforced concrete ductbank (RCDB). Communications Ductbanks, where Specified in Division 27 to be Concrete incased, shall also comply with RCDB requirements.

Low voltage site lighting and other branch circuits may be installed direct-buried conduits.

Coordinate the placement of proposed underground ductbanks and manholes with TAMUS and the utility provider.

General requirements All under Ground include:

- Install warning tape above all underground raceways for low-voltage conductors as described in “Underground Warning Tape”
  - Specify a metallic tape or material containing a metallic strip integral to the tape so that it is detectable from above the ground surface.
  - Tape color shall be bright red and be marked in black letters “CAUTION: BURIED ELECTRIC LINE BELOW.”
  - In grassy areas, place tape approximately 12 inches below finished grade; in areas where ductbank will be below concrete or stabilization material, coordinate tape placement with civil engineer.
  - Extend warning tape continuously for the full length of the run.
- Maintain minimum separations between power levels as described in IEEE 518.
- Do not combine MV, LV or Communication ductbanks.
- Maintain 36 inches separation between electrical and other services/utilities for parallel routes and 12 inches separation at vertical crossings.

- Maintain minimum of 3 inches between conduits.
- Specify PVC-coated or tape-wrapped RGS conduit and factory fittings for stub-ups into indoor and outdoor equipment or where conduit come in contact with the ground. Specify bending radius equal to or greater than the minimum bending radius of the conductors.
  - Where polyvinyl chloride (PVC) coating is used for supplementary protection, it shall consist of a minimum of 20 mils thick, 2-inch wide field-applied PVC tape wrap, or 40 mils thick factory-applied PVC coating.
- Install a nylon pull rope rated for the appropriate tensile strength in all spare conduits and conduits in which percent fill is less than 50%.
- Include a minimum 33% spare
- Show cross-section details on the drawings for each conduit configuration including section cuts referenced from plans; indicate spares.
- Perform initial cable calculations in accordance with IEEE 576.
- Specify that the contractor give notice to TAMUS before cables are pulled so that the TAMUS inspector may observe the pull.
- Do not assume free use of spare conduits.

### Reinforced Concrete Ductbank (RCDB)

Design RCDB to meet the requirements as follows:

- Do not route MV or Communications lines beneath building foundations expect for conduits that terminate inside building.
- For MV ductbanks, provide at least 20 feet of separation between building foundations, existing manholes, and existing ductbanks with new ductbank.
  - An exceptions may reduce clearance when building foot print cannot fit in allotted space and meet clearances. As long as (1) the structural integrity of the duct bank and building foundation is not compromised, and (2) adequate access is provided on one side of the ductbank run for excavation equipment.
- Specify a minimum cover of 30 inches from grade to the top of the concrete ductbank.
- Design ductbank and manhole systems to slope away from the building and toward manholes with sumps at a minimum of 4 inches per 100 feet (0.33%).
- When multiple manholes are uses (on same ductbank system), design system to slop to common manhole.
- Where cables enter manholes, handholes, or underground pull boxes, fill the lower rows of ducts and leave the upper rows of ducts spare to facilitate future cable pulls.
- Locate spare conduit stub-ups into equipment to facilitate future cable installation.
- Minimum Schedule 40 polyvinyl chloride conduit (PVC).
- Concrete shall have a minimum compressive strength of 2,500 psi at 28 days.
- Specify steel rebar at each corner and rebar stirrups at sizes and intervals for the entire length of the ductbank. Provide reinforcement at the point where ductbanks enter manhole or building walls. Reinforcement may consist of PVC-coated or tape-wrapped hot-dipped RGS conduits or heavy-wall fiberglass-reinforced (FRE) conduits extending to a minimum of 10 feet from point of entry into ductbank.
- Specify bell ends manufactured of RGS or heavy-wall fiberglass at the points of penetration/termination.



- Specify all bends over 30 degrees to be of metal conduit.
- Provide 6 inches concrete around the exterior of duct bank.
- Specify factory-fabricated, interlocking, cast-in-place spacers designed to arrange, support, and fix conduits in concrete encasements. Spacers shall interlock vertically and horizontally.
- Specify bend radius of 48 inch.
- Arrange spare conduits to facilitate future cable installation where ductbanks enter manholes, handholes, equipment enclosures, or other pulling spaces.
- Install a continuous bare #2/0 AWG copper conductor centered within ductbank that runs the full length. (To serve as Ufer-Ground)
- Medium-Voltage ductbanks shall:
  - Use Trade size 6” for all MV cable between Manholes and Pull boxes, and minimum 4” for all MV cables to facility transformers
  - Include minimum 2” for utility communication and LV power.
  - Additional Spare conduits maybe requested for future growth.
  - For ductbank identification purposes, mix a minimum of 15 pounds of synthetic iron oxide, (ChemSystems Inc. #120 “Conduit Red” or equal) per cubic yard of concrete, so that the concrete when cured has a distinctive red color. The TAMUS Inspector may direct more to achieve the appropriate color.
- Low-Voltage ductbanks shall:
  - Be a minimum trade size of 2”
  - Steel reinforcement may be excluded based on soil reports and Civil engineers approval.
  - Include minimum two spare 2” conduits from facility to facility transform, for future controls.
- Communications ductbank shall:
  - Warning tape shall be bright orange and be marked “CAUTION: BURIED COMMUNICATIONS LINE BELOW.”
  - A minimum trade size of 4”

### Duct Blockage Tests

Specify that the contractor perform a test for duct blockage or deformation for all ductbanks after the concrete has cured for 24 hours.

- Use a flexible mandrel/scrapper no smaller than 1/4 inch less than or 80% of the internal diameter of the duct to be tested, or other TAMUS-approved means.
- Replace any duct section found blocked.
- Notify TAMUS inspector not less than 14 working days before duct tests.
- Submit written reports of tests to TAMUS inspector using Duct Blockage Test Form 26A-6.1 and foldout diagram of each manhole identifying each duct subject to test.

### Direct-Buried Conduit

- Specify Schedule 80 PVC conduits where installed outside the building perimeter.
- Specify Schedule 40 PVC conduits where installed inside the building perimeter.

- Do not mix Schedule sizes on the same route.
- Specify minimum trade size 1-inch.
- Bury conduits at a minimum depth of 24 inches.
- Support conduit with spacers as described RCDB Requirements.
- Encase all sides of the conduits in a minimum 3" sand bedding within the trench; use cement-stabilized sand where routed below pavement. Add backfill material above the sand bedding up to finished grade and compact per structural engineer.
- Install a concrete cap, minimum thickness of 2 inches, above conduits where not under other concrete (or equal) surface.

### Manholes and Vaults

Provide precast concrete manholes and vaults dedicated to the campus medium-voltage utility and distribution system. Include all standard hardware and accessories. Design manholes/vaults in accordance with IEEE C2 Rule 323. Please see Texas A&M's Utility Energy Services Standard <https://utilities.tamu.edu/design-standards/>. Note: Drawing may differ from actual requirements.

- Use 400 feet as standard spacing between manholes.
- Arrange manholes so conduits enter on same relative height of manhole.
- Conduits shall enter a minimum of 12 inches above manhole floor.
- Provide with manhole as a minimum:
  - Thin-wall knock-outs on every wall
  - Hot-dip Galvanized ladder anchored to floor and wall.
  - Ground rods and Ground ring (see TAMU UES standard)
  - Sump pit with floor grate
  - Sump pump (required for manholes designed to contain submersible switchgear)
  - Non-corrosive/corrosion-resistant ladder-up safety post
  - Heavy-duty fiberglass cable racks and arms
  - Non-corrosive/corrosion-resistant pulling irons
- All Vaults ( for switches, transformers, and other gear) shall have
  - Minimum 8 inch thick walls, and minimum 18 inch depth basin.
  - One 3/4 inch copper clad ground rod (two on main campus)
  - Minimum 2/0 ground ring that wraps along the walls of the interior of vault.
  - Opening should leave a minimum of 6 inches, from walls, around all theoretical conduits. Do not decrease 3 inch spacing of conduits.
- Requirements for communications manholes and handholes are covered in Division 27 - Communications.

### Grounding and Bonding

Show bonding and grounding of medium-voltage and low-voltage equipment on one grounding system diagram prepared for each project.

Install grounding systems for medium-voltage systems and equipment in accordance with NEC 250 Part X, IEEE 142, IEEE C2, IEEE 81 and IEEE 1100.

Soil resistivity should be determined for each site as part of geotechnical report. Use a reliable measurement to determine the soil resistivity such as the four-electrode Wenner Method as described in ASTM G57-06. Perform calculations of grounding electrode resistance using the measured soil resistivity values and the methods outlined in IEEE 142

### **Grounding and Bonding for Medium-Voltage Systems**

Refer to the electric utility distribution system characteristics information presented at the end of this section for the various TAMUS campuses for the primary system grounding requirements.

New campuses that operate their own electrical utility system are required to have single-point grounded-neutral systems. The A/E will need to evaluate the soil resistivity and potential fault levels at the campus location and make recommendations as to whether a solidly grounded-neutral or an impedance grounded-neutral system is more suitable. IEEE 142 provides guidelines in the selection of these types of grounding systems.

- Bond the shields of medium-voltage cables to the equipment grounding means (lug or bus bar) inside each equipment enclosure where terminations, splices, and bonding connections are made.
- For solidly grounded medium-voltage systems, install a #2 AWG minimum, 600V Type XHHW-2 equipment grounding conductor within the raceway (e.g., duct or conduit) with the circuit conductors and bond to equipment.
- Provide a dedicated ground rod at each outdoor medium-voltage switchgear and transformer.

### **Grounding and Bonding for Low-Voltage Systems**

The low-voltage portion of the grounding system will typically originate at the secondary side of the service (utility) transformer and extend to the neutral and equipment grounding buses in a branch-circuit panelboard. Grounding system shall have a ground resistance not to exceed 5 ohms for low voltage. Data Centers shall have a ground resistance not to exceed 1 ohm.

Design a main grounding electrode (MGE) as:

- A “Ground Ring” completely around the perimeter of the building, 3 feet below grade and at a minimum distance of 3 feet outside the structure foundation.
- Ground Ring should be sized based on ground study but as a minimum of 4/0
- Ground ring should be bare copper.
- Bond each perimeter structural steel column to the MGE ground ring. Specify an IEEE 837-compliant high-compression type connector listed for the purpose.
- Specify all bonds below grade to be an exothermic weld.
- Specify ground rods to be a minimum 3/4 inch diameter 10 ft long.
- As a single point ground, specify a copper “Ground Bar: located in the Main Electrical Room adjacent to the service-entrance equipment.

- Minimum dimensions: 1/4 inch by 2 inches, but with a cross-sectional area not less than 25% of the aggregated cross-sectional area of the connected feeders.
- Specify pre-drilled and tapped NEMA 2-hole connections with minimum 25% spare.
- Label each connection
- Mount on insulated supports
- Use a dedicated ground electrode to connect to “Ground Ring”.
- Include a like Ground bar in all other electrical rooms, connecting back to Main.
- Main transformer shall have a minimum of one ground rod, and unless otherwise noted shall be a solidly bonded neutral. Use minimum 4/0 to bond to “Ground Ring”.
- Use bonding Jumpers from all electrical switchgear, switchboard, and panelboards to system “Ground Bars”. Do not use factory-furnished bonding screws.
- Bond and ground all separately-derived systems to nearest “Ground Bar” or “Ground Ring” do not exceed system ground resistance requirements.

### Isolated-Ground Systems (IG)

- Derive each IG power system using a K-rated, dry-type transformer with electrostatic shielding between primary and secondary windings and supplied by a dedicated feeder.
- Specify a 200%-rated neutral bus, and a 1005 rated Ground Bus
- Use bonding jumpers; do not use a factory-furnished bonding strap or bonding screws.
- In addition to the equipment grounding conductor, install a dedicated full current rated 600V insulated (green/yellow) IG grounding conductor for each IG branch-circuit and feeder.
- Show all IG conductors on wiring diagrams.

### **Lightning Protection Systems**

Provide a lightning protection system (LPS), including surge protection as described under for every new building and structure on TAMUS property. Exemptions will be considered only if the results of a Lightning Risk Assessment performed by the A/E in accordance with NFPA 780, Annex L indicate a low risk of damage or injury that is acceptable to TAMUS.

Design LPSs in accordance with NFPA 780, LPI-175, and UL 96A.

- For building additions, extend the existing LPS to the addition structure if the addition is not within the zone of protection.
- Specify UL 96A Class II materials for all LPSs regardless of structure height. Refer to NFPA 780, Table 4.1.1.1.2 for a list of Class II minimum material requirements.
- Coordinate roof wall penetrations with other disciplines to ensure that the integrity of the facility envelope is not compromised.
- AE shall provide:
  - LPS Lightning Risk Assessment in accordance with NFPA 780, Annex L.
  - Performance specification.

- Preliminary lightning protection roof plan including conductors, air terminals, and connections to roof-mounted mechanical equipment.
- Building grounding plan (same plan as described in “Grounding and Bonding for Low-Voltage Systems” [3.12]) showing locations of MGE ground ring, down-conductors, ground rods, and ground test wells.
- Typical connection details for air terminals, Ground Ring, ground rods, down conductors, parapet wall penetrations, and ground test wells.
- Specify use of Building ground ring. Do Not install 2 ground rings
- Terminate each LPS down-conductor at a dedicated ground rod and bond both the down-conductor and ground rod to the building MGE ground ring.
- Bond all metallic objects such as pipes and conduits crossing the ground ring.
- Provide ground test wells at accessible locations along the ground ring.
- Install LPS conductors in Schedule 80 PVC conduit if routed inside the building or structure.
- Consult building envelope designer on best means of entry.
- New buildings or Buildings who’s master envelope is being altered shall be certified with minimum of either a Master C label from UL or Inspection Program label from LPI upon installation of the system.

**APPENDIX A – LIST OF CONTENTS**

<b><u>Reference No.</u></b>	<b><u>Title</u></b>
Figure 26A-1	Sample Arc-Flash Hazard Warning Label
Form 26A-2	Medium-Voltage Cable Testing Information Form
Form 26A-3	Duct Blockage Test Form

 <b>WARNING</b>			
<b>Arc-Flash and Shock Hazard</b>			
Appropriate PPE Required			
Flash Protection Boundary	<u>32 inches</u>	Available Fault Current	<u>35 kA</u>
Hazard Risk Category	<u>1</u>	System Voltage	<u>480 VAC</u>
Incident Energy at 18" (cal/cm <sup>2</sup> )	<u>2.77 cal/cm<sup>2</sup></u>		
<b>REQUIRED PPE</b>			
<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Flash Hood	<input checked="" type="checkbox"/> Voltage Rated Gloves	<input checked="" type="checkbox"/> FR Pants
<input type="checkbox"/> Safety Glasses	<input type="checkbox"/> Ear Protection	<input checked="" type="checkbox"/> Leather Gloves	<input type="checkbox"/> FR coverall
<input type="checkbox"/> Safety Goggles	<input type="checkbox"/> T-shirt	<input type="checkbox"/> Cotton Underwear	<input type="checkbox"/> Flash Suit
<input type="checkbox"/> Face Shield	<input type="checkbox"/> Long Sleeve Shirt	<input type="checkbox"/> Long Pants	<input type="checkbox"/> Leather Shoes
	<input checked="" type="checkbox"/> FR Shirt		
<b>SHOCK HAZARD APPROACH BOUNDARIES</b>			
Limited	<u>42 inches</u>	Restricted	<u>12 inches</u>
		Prohibited	<u>1 inch</u>
Equipment ID: Bus: <u>SERVICE4</u>		Date: <u>05/12/05</u>	

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## MEDIUM VOLTAGE CABLE TESTING INFORMATION FORM

*CONTRACTOR SHALL SUBMIT COMPLETED TO TAMUS INSPECTOR AT LEAST 14 DAYS PRIOR TO TEST*

PROJECT NAME \_\_\_\_\_

PROJECT NUMBER \_\_\_\_\_

CONTRACTOR NAME \_\_\_\_\_

DATE AND TIME OF TEST REQUESTED    /   /       :   AM / PM

REQUESTED BY: \_\_\_\_\_

CABLE MANUFACTURER \_\_\_\_\_

CABLE SIZE \_\_\_\_\_

CABLE RATED VOLTAGE \_\_\_\_\_

# OF CONDUCTORS \_\_\_\_\_

ACTUAL VOLTAGE \_\_\_\_\_

INSULATION TYPE \_\_\_\_\_

THICKNESS (MILS) \_\_\_\_\_

AGE OF CONDUCTOR(S) NEW \_\_\_\_\_ OLD (YRS) \_\_\_\_\_

LENGTH OF CONDUCTOR(S) \_\_\_\_\_

TYPE OF TERMINATIONS: \_\_\_\_\_

ELBOWS (MFR) \_\_\_\_\_

STRESS CONE (MFR) \_\_\_\_\_

CABLE END LOCATIONS \_\_\_\_\_

Physical and Electrical Inspection Completed?	Yes / No	Date:
---	----------	-------

Inspector Name:		
Contractor Name:		
Contractor Phone and e-mail:		
Manhole # :		
Conduit (s) ID		

**Objective:**

1. To verify that all conduit is in acceptable condition.
2. To verify that all conduit have pulling string per specifications

**Test Equipment:**

Conduit Diameter: \_\_\_\_\_  
 Mandrel Size: \_\_\_\_\_

**Success Criteria:**

1. All conduit is installed per contract documents
2. All conduit is continuous without obstruction between junction boxes
3. All conduit is clean and in good physical condition

**Test Procedure:**

Procedure Description	Measured	Results Pass/Fail
Verify conduit is the correct size and color.		
Verify the conduit is clean and terminated per contract documents in the junction boxes.		
Verify mandrel is at least 80% of the conduit internal diameter, at least twice as long as the conduit diameter, composed of rigid material.		
Verify mandrel moves freely through the entire length of all conduit runs.		

**Test Completed by:**

**Date:**

**TAMUS Representative Witness:**

\_\_\_\_\_  
Signature

\_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_

\_\_\_\_\_

Print Name

Print Name

**Manhole #**

		<p>O O O O O</p> <p>O O O O O</p> <p>O O O O O</p> <p>O O O O O</p> <p style="text-align: center;">O O</p>	
<p>O O O O</p> <p>O O O O O</p> <p>O O O O O</p> <p>O O O O</p> <p>O O O O</p>			<p>O O O O</p> <p>O O O O O</p> <p>O O O O O</p> <p>O O O O</p> <p>O O O O</p>
		<p style="text-align: center;">O O</p> <p>O O O O O</p> <p>O O O O O</p> <p>O O O O O</p> <p>O O O O O</p>	

**NUMBER DUCTS: NORTH, EAST, SOUTH, WEST WALLS**

**(EXAMPLE: N1-N22, E1-E22, S1-S22, W1-W22)**

**LIST DUCT NUMBERS ABOVE IN CONDUIT ID SPACE AFTER VERIFICATION OR FAILURE**

**Campus Specific Information**



## Texas A&M University

The Utilities and Energy Services department at Texas A&M University in College Station, Texas maintains prescriptive design standards for many systems. These standards are found at <https://utilities.tamu.edu/design-standards/> .

## West Texas A&M University

### Circuit Breaker Panel

All breaker panels shall be Square D or approved equal.

### Lighting

#### Exterior Site Lighting

Kim Lighting Solitaire SRS Fixtures – 4200K LED Fixture (Walkway and Roadway)

Nominal 18” diameter round cast aluminum fixture supported with 4 cast aluminum arms, solid top, clear tear drop high temperature rated acrylic lens, segmented Alzak reflector, cast aluminum door frame with silicon gasket and quarter turn captive fasteners. Fixture supported by nominal 14 foot tall round straight 4” diameter extruded aluminum pole with provisions for flush fixture mounting. Flush handhole with removable cover, round aluminum anchor base plate, four anchor bolts with hex nuts and flat washers. Addition of a receptacle on the pole will be determined with each project. Pole shall be capable of withstanding 90 mph wind with 1.3 gust factor at rated fixture 1.5 EPA, two piece cast aluminum decorative base cover.

R.A.L. polyester powder coat paint color #3005 Wine Red. Note: Pole handhole must be placed above the top of the decorative base cover.

Two nominal 18” diameter round cast aluminum fixtures supported with 4 cast aluminum arms, solid tops, clear tear drop high temperature rated acrylic lenses, segmented Alzak reflectors, cast aluminum door frames with silicon gasket and quarter turn captive fasteners and twin-mount arm. Fixture supported by nominal 20 foot tall round straight 5” diameter 11 gauge steel pole with provisions for side arm fixture mountings at top. Flush handhole with removable cover, round aluminum anchor base plate, four anchor bolts with hex nuts and flat washers. Addition of a receptacle on the pole will be determined with each project. Pole shall be capable of withstanding 90 mph wind with 1.3 gust factor at rated fixture 4.25 EPA, two piece cast aluminum decorative base cover. R.A.L. polyester powder coat paint color #3005 Wine Red. Note: Pole handhole must be placed 30” above the top of the decorative base cover.

U.S. Architectural AER Aerolume series – 4000K LED Fixtures (Parking Lots)  
One-piece rectangular cast aluminum fixture. Full optical cutoff, type 5 square pattern segmented reflector, convex clear tempered glass lens, die cast aluminum door frame with silicon gasket and captive fasteners, 9” long side arm mounted to pole. Nominal 40 foot tall round tapered steel pole with provisions for side arm fixture mounting at the top. Flush handhole with removable cover, square steel anchor base plate, four anchor bolts complete with hex nuts and flat washers and four die-cast nut covers. Pole shall be capable of withstanding 90 mph wind with 1.3 gust factor at rated fixture EPA. Addition of a receptacle on the pole will be determined with each project. R.A.L. polyester powder coat paint color #3005 Wine Red.

Incandescent Lights – When possible, use compact fluorescent or LED bulbs of sufficient wattage to provide adequate light levels for the room function. Where compact fluorescent or LED bulbs are not applicable, use high efficient incandescent bulbs or replace the fixture with a standard fluorescent or LED fixture. NO 277 volt incandescent fixtures shall be used, except for VHAC Men and women’s showers.

Troffer or Linear Surface Mount Fixtures:

LED – 4000K - dimmable

Exit Lights:

Compass CERRC: exit sign: Emergency battery backup, LED, White, Red, 1 or 2 faces, ceiling, Nickel Cadmium, White

Compass CCR: exit sign with emergency lights: white 1 or 2 faces, Red, LED, Wall/ceiling, Nickel Cadmium

Museum –The Museum will require coordination with the Museum curator on a case-by-case basis. Consideration will need to be given to the Ultra-violet rays given off by certain types of lighting. In addition, filters may be required to protect certain exhibits.



### 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. Bonding to the electrician provided

ground.

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, and the temperature range, humidity and number of air changes/hour are a 7/24 requirement as noted in the 569-C (as suggested by ASHRAE).

Do not locate ductwork or plumbing clean outs in electrical or telecom rooms. These spaces (per 569-C) should be dedicated to division 27 low voltage communications systems oriented infrastructure only.

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

## Division 27 – Communications

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 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 – (Reference the TIA-568-C and the TIA-1152 testing standard). The Contractor shall test the computer (data) and telephone wiring systems for conformance with the TIA/EIA 568-A Category 5e or 6 (appropriate to install) wiring standards. 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. Also, in Excel spreadsheet form, a list of outlet numbers and the corresponding room numbers and cable lengths, should be provided. Laminated half size as built drawings indicating each outlet location and outlet number should be provided for mounting in each TR/ER. All documentation should be provided on a compact disk or DVD. Cables tested with a Fluke DTX-1800 or newer should provide results in Linkware, (Fluke's proprietary software), again a complete test including cable number and room destination.

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. Do 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".
- 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%

Fiber should be tested with an Optical Loss Test Set (OLTS or Tier 1 tester) for the media and length and full test results provided on CD or DVD.

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 multipoint directional couplers in a telecommunications room. Homerun all cables between the telecommunications room and wall outlets with cable lengths not to exceed 300 feet.

## Division 27 – Communications

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 multipoint directional coupler locations shall be plenum rated, bonded-foil tri-shield construction Type RG-11 coaxial cable.

All cables between multipoint 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 multipoint 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 multipoint 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

Project A/E shall refer to Network Installation Design Standards located at [Texas AandM University Network Installation Design Standards 12-1-2021 \(tamu.edu\)](https://www.tamu.edu/network/installation-design-standards)

#### West Texas A&M University

### Telecommunications and Computer Wiring Specification

General - All telecommunication wiring shall be installed in accordance with national recognized standards of BICSI. Telephone and computer outlets shall be at plug height on open walls and counter top or credenza height on covered walls.

Data/Voice Outlets – Shall be Ortronics Trac-Jack and fully compliant with EIA/TIA

## Division 27 – Communications

568A standard. Data jacks will be 8-pin keyed RJ-45, and will utilize 568A-wiring scheme at a certifiable level of 6 or greater. In locations of multiple consolidated voice and data jacks, duplex boxes and duplex inserts will be accepted to minimize surface penetrations. Cable manufacturers conduit fill capacities will be adhered to with no more than 60% fill accepted. Minimum conduit size is  $\frac{3}{4}$ ".

Wire and Cable – Shall be Berk-Tek Lanmark 1000 or approved equal. Communications cabling shall be plenum rated meeting all federal and state codes. The cable shall be four pair, 24AWG cable compliant with EIA/TIA 568A standards for 6 certification. Cable sheath shall clearly indicate UL, EIA/TIA 568A (6) compliance. The contractor shall provide ten extra feet of cable at the hub end and two extra feet at the outlet. For all small contract or internal remodel projects WTAMU telecommunications will terminate all wires. For all new building construction or major renovations the contractor shall provide all terminations.

Cross-Connect - All data cabling shall terminate to a Patch Panel (Ortronics: OR-PHD66U48). Patch Panels shall be mounted with management trays on all four sides with sufficient space to accommodate the port density of the panel. Patch Panels shall be over-sized to provide 24 spare ports or 25% more ports than required, whichever is greater. Patch Panels shall be mounted in standard relay style 19" rack with a minimum 36" clearance front and back to allow ease of access.

Telecommunication termination shall be to a 110-style block (Siemon - S110AB2-100FT). Sufficient block space shall be provided to accommodate all telecommunication cables plus an additional 25% spare pairs or 50 pairs, whichever is greater. All terminations shall be labeled with typed or mechanically produced labels. Labels shall indicate architectural location and the outlet number. Standard copper riser will be maintained to service FAX, modem and other legacy services.

Workstation Outlet - Each single gang outlet shall have a minimum of  $\frac{3}{4}$ " conduit into a 4S style box with a single gang ring affixed to accommodate wall depth. Cables shall be terminated to an Ortronics - OR-40300548 plate utilizing Ortronics - OR-TJS600 outlet, orange for data and white for telephone. All outlets shall be properly marked with icon for service type and labeled to indicate architectural location and number of outlet. Configuration for data jacks shall use 568A-wiring order.

Equipment Installation – All equipment is to be installed in strict accordance with manufacture's instructions. Label each cable and jack at both ends with architectural location identification as well as jack number in spaces with more than one termination. Neatly train cables at terminal boards and junction boxes. Support cable with approved cable tray in areas with a span in excess of 2 feet. Use Velcro bands to secure. DO NOT USE NYLON FASTENERS. All cable from outlet to floor/zone closet shall be pulled and terminated. This includes voice and data.

Labeling – Each cable shall be labeled at each termination with adhesive wrap-

identification labels that completely encircle the cable. Label each pin plug with the cable identification

number with a black marker pen on the back of the device plate immediately about the location where that pin plug is mounted. Label each modular block assembly with the cable identification number that is plugged into the connector.

Tests – Test and verify all wire is free from grounds, shorts, opens, and miss-wires. All outlets will be tested TIA/EIA 568A –568a scheme to Category 6 level Basic Link. It will be tested with tester certified to test at the Category 6 level in accordance with TSB67 portion of above standard. Submit reports from above tests with job documentation.

MDF/IDF Room Equipment - Two racks shall be installed by contractor in each MDF and each IDF room. Racks shall be 57004-703 as manufactured by Chatworth Products Incorporated or equal.

Submittals – Submit complete catalog and other descriptive information on each of the components and devices proposed to be supplied for the system. Submit wiring sizes and types as well as termination devices and techniques of terminations proposed as a portion of the submittal. Equipment and accessories furnished under the terms of this Specification shall be the standard products of the manufacturer listed. Catalog numbers and model designations that appear herein indicate design, quality, and type of materials as well as required operating characteristics.

### **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

## Division 27 – Communications

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
- B. ANSI/TIA/EIA-569-A Standard, Commercial Building Standard for Telecommunications Pathways and Spaces.
- C. ANSI/TIA/EIA-570 Standard, Residential and Light 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. Intra-building Fiber Optic Cable

Contractor is responsible for installing, terminating, labeling and testing any required intra-building fiber. Contractor must submit a proposed cable route to Tarleton Telecom for approval prior to 100% design completion.

### D. Intra-building Copper Cable

Contractor is responsible for installing, terminating, labeling and testing any required intra-building 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 1000meters @ 1310nm; 40000meters @ 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 500m @ 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 10000meters @ 1310nm; 40000meters @ 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:

## Division 27 – Communications

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 pigtailed.

### **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 6 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 (4X the cable OD is the standards rule) that could compromise the integrity of the cabling.

## Division 27 – Communications

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:

Quantity	Description of Item
1	PT-FW300U Panasonic Projector
1	CSM 440 Chief above ceiling mount
1	RPAUW Universal Projector mount
1	UCS880-GM Mobile MM WS W/19In Rack Cab Cart
1	60-818-03 Extron MLC 104 IP Plus Media Link Controller with IP

## Division 27 – Communications

1	70-283-01 Extron IR Emitter Kit: With Shield
1	60-569-01 Extron IN 1508Eight Input Scaling Presentation Switcher with PIP
1	60-046-03 Extron P/2 DA2 PLUS-Two Output VGA-QXGA
1	60-844-01 Extron MPA 152 Stereo Power Amp 15 Watts
1	60-640-02 Extron SMB 102 TWO-GANG BLACK
1	<b>16:10 Ratio</b> SMART IS 422w interactive display or <b>4:3 Ratio</b> SMART SSID-370-ED Symposium ID370 Interactive Display-17"
1	DMPBD60K Blu-ray Disc Player with 1080p Upconversion
1	S1 1 Mid Atlantic SPACE (1 3/4") SECURITY COVER,
5	32-3121BU BNC (F) - RCA (M) Adapter
2	32-284 DB9M-RJ45 Adapter (Hood) - GRAY
1	UL210BD Wiremold Outlet Center,
1	UTR1 Mid Atlantic HALF/THIRD RACK UNIVERSAL SHELF
1	DTCSSLEEVING PTN1.25BK Flexo Cloth mesh
1	D7508-WQ153357 Clear 3 Gang Wall Plate--
1	VZ-8light3 Wolfvision Desktop Visualizer - VZ8Light3:
1	150-006 6 Foot M/M Premium SVGA Cable
1	071-003 3 Foot RCA Python Cable
4	072-003 3 Foot Stereo Python Cable
1	060-003 3 Foot Component Video Cable
1	128-006 6 Feet M/M SVGA Cable With 3.5MM Audio
1	039-003 3 Foot Male to Male 3.5mm Stereo Audio
1	009-003 1 Meter, 3.3 Foot, DVI-D to DVI-D,
1	039-023 3 Foot Male to Female 3.5mm Stereo Audio
1	032-118 150 Foot USB 1.1 Over Cat5E Extension Repeater
1	072-025 25 Foot Stereo Python Cable
1	091-325 25 Foot Cat5E 350MHz Patch Cable - Black
1	090-125 25 Foot Cat5E 350MHz Patch Cable - Grey
1	092-625 25 Foot Cat5E 350MHz Patch Cable - Yellow
1	091-425 25 Foot Cat5E 350MHz Patch Cable - Red
1	090-225 25 Foot Cat5E 350MHz Patch Cable - Blue
1	151-025 25 Foot M/M Premium SVGA Cable
2	131-20 16 Foot USB 2.0 Cable, A Male to B Male
2-4	Quam C10 Series Speakers, mounts and back cams

### 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.

Quantity	Description of Item
1	PT-FW300U Panasonic Projector
1	CSM 440 Chief above ceiling mount

1	Crown XTI series Amp
	Draper Electric screen with low voltage controller(type depends on dimensions)

**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:	
<p>Qty P/N Description                      5 R1 RJ-45 CAT 5e PUNCHDOWN (BLACK)                      1 V5 HD-15 FEMALE FEEDTHRU (30-587)                      1 R11WHT ISOLATED RCA SOLDER                      1 R11RED ISOLATED RCA SOLDER</p>	

In a Standard classroom configuration, the location of the triple gang wall box will require two network pulls (One for the computer laded PC and one for the room controller laded 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**

#### **STAFFING AND QUALIFICATIONS**

Contractor must be a current Leviton Premier Network Installer

#### **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.

#### **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):

## Division 27 – Communications

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 # XXXXXXXX
  2. Panduit vertical management double sided # PRV6
  3. Panduit vertical management doors # PRD6
  4. Panduit vertical management slack spools # PRSP5
- P. 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
- Q. Overhead ladder supporting hardware: CPI
1. Runway Radius Drops 12100-712, 718
  2. Runway Pathway Dividers 13392-722
- R. Emergency call box: RamTel PLW-6 w/ University logo
- S. Building entrance terminal: Model #195 Lucent
- T. Fiber Optic Splice Enclosure:

1. Leviton # VSC12-STD

U. Fire Stop systems: EZ-Path

V. Labeling: Brady

W. 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,

### **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.

### **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.
- B. Install approved vendor rack radius drop on top of vertical cable management to protect cabling bend radius. See CPI part #13183-179.
- C. 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.
- D. Locate/space racks and enclosures (cabinet) according to EIA/TIA guide lines for front and rear access clearances and as per Telecommunications drawings.
- E. As a general guideline follow the typical telecommunications room details design see

attachment A.

### **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.

### **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.

### **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.

## Division 27 – Communications

- 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.

### **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.

### **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.

### **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.

### **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.

### **PLYWOOD BACKBOARDS**

- A. Provided by General Contractor and/or Div. 16 Min. one (1) 8'H x 4'W x 3/4" 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.

## Division 27 – Communications

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.

### **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.

### **FIBER AND COPPER SPLICING 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.

### **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.

### **PATHWAY AND SPACES**

- A. Chases and slots must maintain a 50 % spare capacity.
- B. Refer to communications standards.

### **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.

### **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.



## Division 27 – Communications

- 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.

### 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) 1 ¼-inch inner duct.
  - 3. Provide one (1) inner duct per 2-inch conduit. One (1) 1 ¼ -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.

### 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.

### **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 6eX, 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.
5. Color-coding shall match TIA/EIA 568-A standards.
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.

### **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.

### **FIBER PATCH CORDS**

- A. All fiber optic patch cords to be provided by contractor. Consult owner on exact lengths and quantities prior to purchase.

### **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.

### **HORIZONTAL CABLING 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. 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.

## Division 27 – Communications

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. 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

## Division 27 – Communications

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.

### **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.

### 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.

### 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.

### **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.

### 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.

### 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

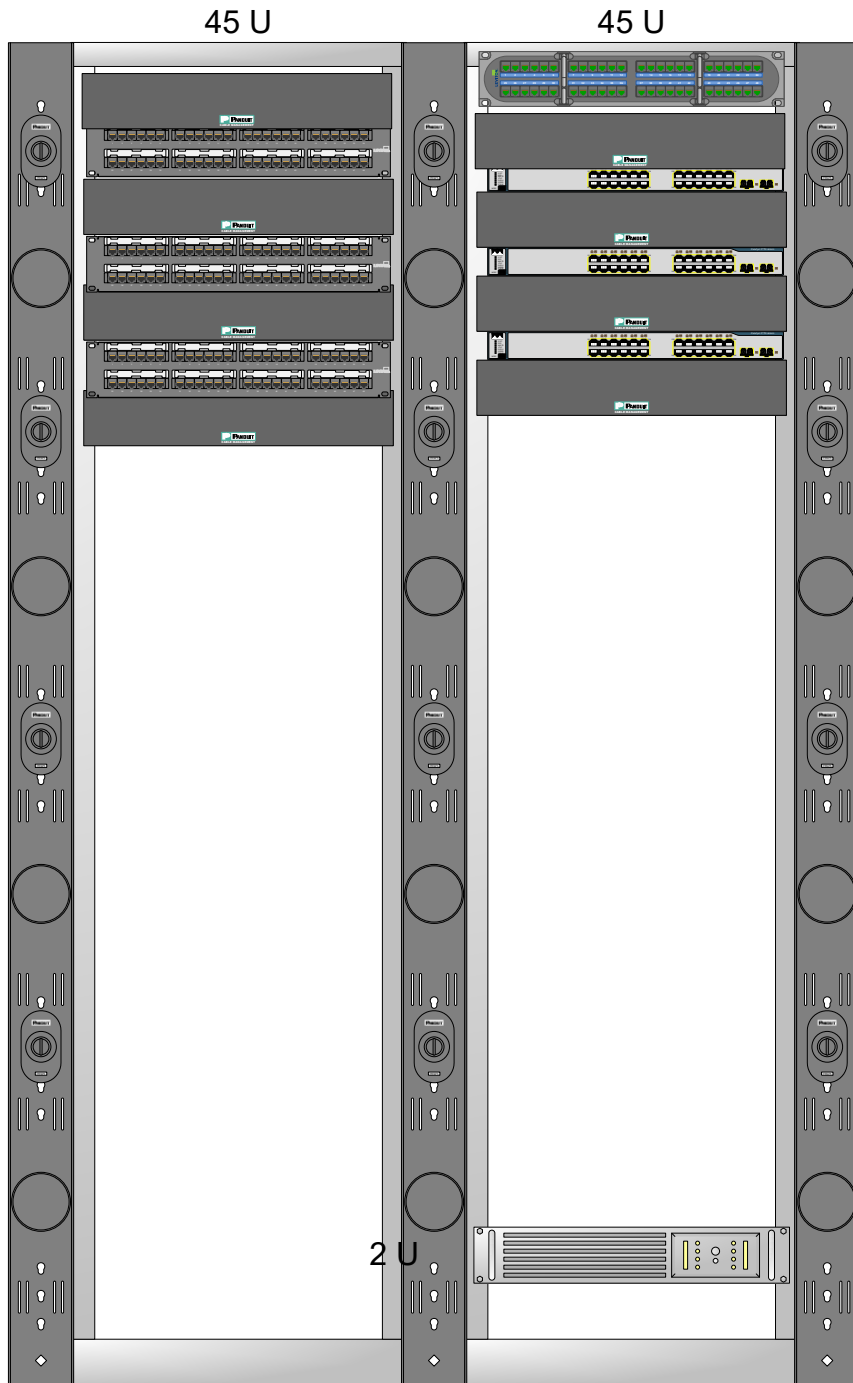
performance specification shall be marked as a FAIL.

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.
9. Overall pass/fail indication.
10. Date and time of test.
11. Test reports shall be submitted before substantial completion of the project.

### **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.

Attachment A



## 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

### Texas A&M University

Refer to guidelines from Environmental Health & Safety located at [tamu-fire-safety-design-installation-acceptance-guide-for-fire-and-life-safety-systems-4-26-2018.pdf](https://ehs.tamu.edu/files/2018/04/tamu-fire-safety-design-installation-acceptance-guide-for-fire-and-life-safety-systems-4-26-2018.pdf)

### 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

Fire Alarm System shall be Siemens Pyrotronics.

## Gold Card Controlled Access & Vending/Laundry Specification

Communications:

A network drop is required to feed an IP Converter (furnished by owner) located in the

## Division 28 – Electronic Safety and Security

main communication MDF room. From the backside of the IP converter Cat5 yellow jacketed 10BaseT cable is to run to each wall jack for vending (daisy chained uncut from jack to jack), to any laundry reader and to each door access reader box location (if possible door access reader boxes are to be located in the nearest electrical or telecommunications closet).

### Door Access:

Four runs of Belden 8723 are required from the main reader box (located in the electrical/communication closet) to each door - 1 for the strike, 1 for the magnetic door position/status switch, 1 for the exit switch/PRI (electric eye), and 1 for the swipe on the out side of the door. To support the card swipe a single gang box with a conduit stubbed above the ceiling shall be provide.

If there will be automatic door opener a fifth run of Belden 8723 is required from the main reader box to the door controller.

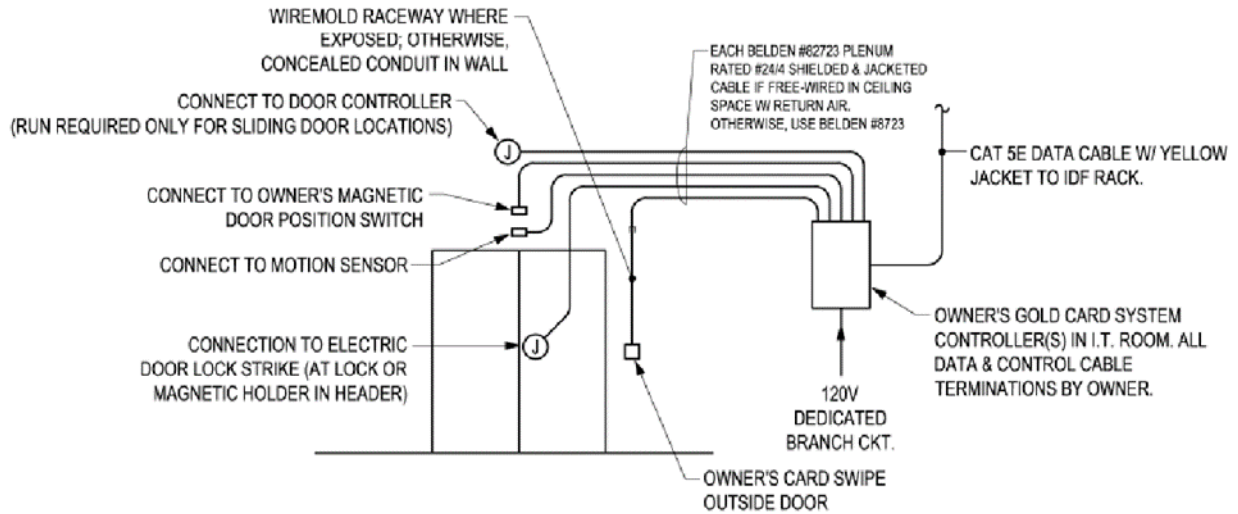
Electronic strikes shall be H.E.S. 9600 Series or 5000 Series.

Door access power requirement – Each Door Access Power Supply box requires 110v AC. If an IP Converter is used for communications, one single-gang duplex 110v AC plug is needed near the location that the IPC will be mounted.

### Wireless Configuration Requirement:

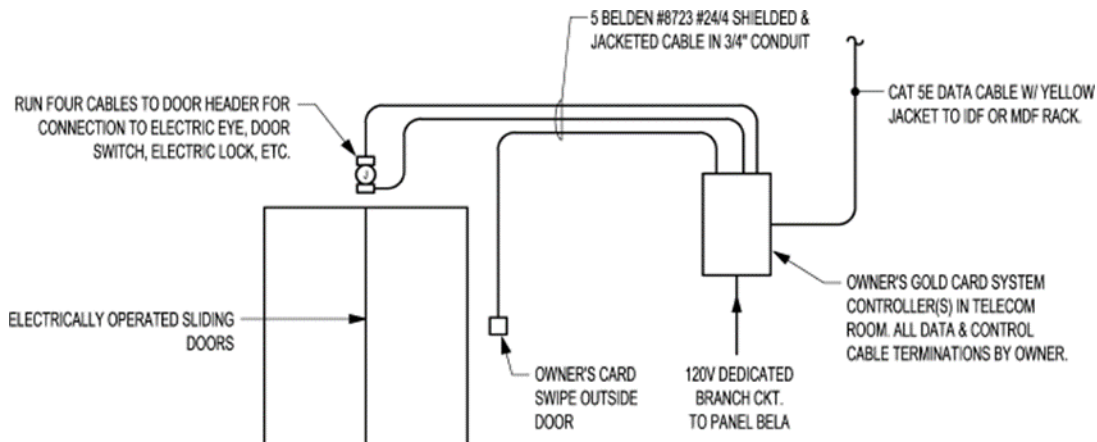
If it is determined that wireless can or should be used. Contractor will need to consult with the WT Lock Shop Manager for make, model and style specifications to ensure compatibility with the Buffalo Gold Card system. Also, if it is determine due to building construction the wireless transponder must be relocated closer to the door(s), Cat5 network cable to be ran from transponder location back to tele-com room where controller will resides. Also, a single-gang duplex plug (110v) will also be need at the transponder location.

## Division 28 – Electronic Safety and Security



### TYPICAL ENTRY CONTROL SYSTEM

NO SCALE



### TYPICAL SLIDING DOOR ENTRY CONTROL SYSTEM

NO SCALE

NOTE: ALL GOLD CARD PUNCH DOWNS SHALL BE E17/T1A SEQUENCE 568B (568A WILL BE USED FOR REGULAR CAT 6 DATA CABLES.)



## Division 28 – Electronic Safety and Security

### Laundry (washer/dryers):

A laundry reader (swipe by owner) and a laundry multiplexer (by owner) will be located in the laundry room. The reader is to be mounted no more than 48" from the floor while the laundry multiplexer can be located in the ceiling with a conduit connecting it to the reader box. Each laundry reader and/or multiplexer would need 110v for power.

Each washing machine and/or dryer require a Belden 8723 wire from the reader box or multiplexer to a wall plate behind each unit leaving a 6' pig-tail to connect into the unit mounted to the washer/dryer by the owner.

## 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.

## Division 28 – Electronic Safety and Security

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
    1. Custodial closets
    2. 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.

## Division 28 – Electronic Safety and Security

- 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.

## Division 28 – Electronic Safety and Security

- 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<sup>o</sup> 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<sup>o</sup> 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.

## Division 28 – Electronic Safety and Security

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.

## Division 28 – Electronic Safety and Security

- 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.

## Division 28 – Electronic Safety and Security

- 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 sealed 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:



## Division 28 – Electronic Safety and Security

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.

## Division 28 – Electronic Safety and Security

- 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

## Division 28 – Electronic Safety and Security

- 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.

## Division 28 – Electronic Safety and Security

**Annex C**  
**Texas A&M University**  
**Fire Alarm System Acceptance Checklist**

**Building #:** \_\_\_\_\_ **Building Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
**Attendees:** \_\_\_\_\_  
 \_\_\_\_\_

Functional test of all Smoke Detectors	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Functional test of all Heat Detectors	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Functional test of all Manual Pull Stations	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Functional test of all Duct Detectors	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Functional test of all Flow Switches	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Functional test of all Audio/Visual devices	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Functional test of all Magnetic Releases	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Functional test of all Remote Annunciators	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Functional test of all Fireman Phones	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Flow test of all Duct Detectors	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
dB level check on all Audible Devices	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Conduct Battery Discharge Test (30 Minutes) / Full Alarm Test (General - 5 Min./Emergency Voice 15 Min.)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Verify That the Locations of All Power Supplies are Identified at FACP	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Functional test of all Relays <ul style="list-style-type: none"> <li><input type="checkbox"/> AHU Shutdown</li> <li><input type="checkbox"/> Elevator Recall</li> <li><input type="checkbox"/> Suppression Systems</li> <li><input type="checkbox"/> Exhaust Fans</li> <li><input type="checkbox"/> Pressurization Fans</li> </ul>	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Verification of Trouble Alarms <ul style="list-style-type: none"> <li><input type="checkbox"/> Smoke Detector Circuit</li> <li><input type="checkbox"/> A/V Circuit</li> </ul>	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Verify all Supervisory Alarms <ul style="list-style-type: none"> <li><input type="checkbox"/> Sprinkler/Tamper</li> <li><input type="checkbox"/> Duct Detector</li> </ul>	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Verify Alarm, Supervisory, & Trouble Signals Received at Radio Room	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Verify Installation of Storage Box	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Sensitivity Test Printout Sent to Electronic Shop Personnel	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
O&M Manual transferred to Electronic Shop Personnel	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Transfer of any special tools to Electronic Shop Personnel	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
FML-009 Form Completed and Transferred to EHSD	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Other:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A

Comments: \_\_\_\_\_

**Division 28 – Electronic Safety and Security**

## 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 topsoil exists on site, strip this material to a depth of 4" and stockpile for reuse in areas to receive grass and other landscaping. Topsoil 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.

## Division 32 – Exterior Improvements

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

## Division 32 – Exterior Improvements

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"
Stripe Colors:	White for general parking. Yellow for no parking, and loading. Blue for accessible.

Landscaped Medians:	Planted with low profile vegetation, irrigated, and spaced appropriate to the design.
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Concrete Mow Strips:	2'-0" wide back of curb for head-in parking when no wheel stops are provided
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Lighting:	0.9 foot candles
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### 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 and Facilities Department.

### **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 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.

## Division 32 – Exterior Improvements

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 doveled 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 affect the lifespan of the sod.

Area to designate 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.



## Division 32 – Exterior Improvements

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. Sleeving pipe beneath pedestrian pavements shall be PVC Class 200 with solvent welded joints. Sleeving 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

Project A/E shall refer to Architectural & Landscape Design Standards located at [design-standards-architectural-landscape.pdf \(tamu.edu\)](https://www.tamu.edu/landscape/design-standards-architectural-landscape.pdf)

Project A/E shall refer to Campus Site Furnishings and Hardscape Standards located at [campus-site-furnishings-hardscape-standards.pdf \(tamu.edu\)](https://www.tamu.edu/landscape/campus-site-furnishings-hardscape-standards.pdf)

Project A/E shall refer to Operational Overview Tree Protection Procedures located at [TREE PROTECTION PROCEDURES \(tamu.edu\)](https://www.tamu.edu/landscape/tree-protection-procedures.pdf)

#### 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](http://www.upbeat.com) for examples. Item# CKSCBEN6) Public areas would be defined as the Thompson Student

## Division 32 – Exterior Improvements

Development Building, The Administration Building, The Trogon 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](http://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, etc. (see [www.upbeat.com](http://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](http://www.upbeat.com) for examples. **Item# L2010**)

**Trash Receptacle 32 gallon** (see [www.upbeat.com](http://www.upbeat.com) for examples. Item# L1378) This trash receptacle is constructed of Plasticol coated steel slats. Color Bronze Lid shall be see [www.upbeat.com](http://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.

#### Landscape Benches, Picnic Tables, Litter Receptacles, and Bollards

Benches as manufactured by landscapeforms: Arcata Bench

- Backed or Backless dependent on application or owners choice.

- Insert – Driftwood Polysite

- Surface mounted

- No arms

- Powder coat color – Cranberry

Picnic Tables as manufactured by landscapeforms: Gretchen Picnic Table

- Driftwood Polysite table and bench

- Surface mount

- No umbrella hole

- Powder coat color – Cranberry

Litter Receptacles as manufactured by landscapeforms: Lakeside litter receptacles

- Custom steel panels –LS999-06003-CDS-WTAMU

- Top opening 35 gallon capacity

- Black polyethylene liner

- Standard freestanding surface mount support

- Powder coat finish - Titanium

Bollards as manufactured by landscapeforms:

- Custom removable Annapolis, 6” removable with special lower lock and shorter socket Drawing: ANPPP-06077

- Lighted - Annapolis

## Division 32 – Exterior Improvements

### Plant Material

Trees:	
<ul style="list-style-type: none"> <li>○ Bur Oak</li> <li>○ Cedar Elm</li> <li>○ Locust Shademaster</li> <li>○ Pecan</li> <li>○ Bald Cypress</li> <li>○ Washington Hawthorn</li> <li>○ Hackberry</li> <li>○ Purple Ash</li> <li>○ Desert Willow</li> </ul>	<ul style="list-style-type: none"> <li>○ Canadian Red Cherry</li> <li>○ Red Bud</li> <li>○ Texas Red Oak</li> <li>○ Lacebark Elm</li> <li>○ Mondale Pine</li> <li>○ Chinese Pistach</li> <li>○ Skyrocket Junipers</li> <li>○ Chitalpa</li> </ul>
Shrubs:	
<ul style="list-style-type: none"> <li>○ Dwarf Crimson Barberry</li> <li>○ Cottoneaster</li> <li>○ Yaupon Holly</li> <li>○ Mahonia Grape</li> <li>○ William Penn Barberry</li> <li>○ Nana Juniper</li> <li>○ Yew</li> <li>○ Photina</li> <li>○ Euonumous (all varieties)</li> <li>○ Dwarf Holly Burford or Yaupon</li> <li>○ Red Yucca</li> <li>○ Groundcover Roses</li> </ul>	<ul style="list-style-type: none"> <li>○ Pom Pom/Spiral</li> <li>○ Privet Green or Variegated</li> <li>○ Nandina</li> <li>○ Eleagnus</li> <li>○ Nelly Holly</li> <li>○ Liriope</li> <li>○ Purple Smoke</li> <li>○ Dwarf Hamlin Grass</li> <li>○ Knock-out Roses</li> <li>○ Dwarf Maiden Grass</li> <li>○ Dwarf Forester Grass</li> <li>○ Blue Gramma</li> </ul>
Color:	
<ul style="list-style-type: none"> <li>○ Mums</li> <li>○ Dianthus</li> <li>○ Miscellaneous Seasonal Color</li> <li>○ Stella D'ore Daylillies</li> <li>○ May night Salvia</li> <li>○ Gallardia</li> <li>○ Artemisia</li> <li>○ Echinacea</li> <li>○ Coreopsis</li> <li>○ Heuchera</li> </ul>	<ul style="list-style-type: none"> <li>○ Yarrow</li> <li>○ Hosta</li> <li>○ Ajuga</li> <li>○ Vinca (Major or Minor)</li> <li>○ Sedum</li> <li>○ Hardy Hibiscus</li> <li>○ Rudebekia</li> <li>○ All Sage / Salrta (hardy)</li> <li>○ Penstemon</li> <li>○ Winter Creeper</li> </ul>
Turf	
<ul style="list-style-type: none"> <li>○ Buffalo</li> <li>○ Fescue</li> </ul>	<ul style="list-style-type: none"> <li>○ Bermuda</li> <li>○</li> </ul>

### Irrigation Standards

#### General Items

If using reclaim water all pipe, valve boxes, etc. shall be Purple in color.

There shall be hose bibs installed on the exterior of all building or on irrigation line, number and locations to be reviewed with each project.

All piping installed outside of building footprint to include tracer wire with accessible tracer points.

Ball Valves: In front of valves (Shutoff), isolation valve

Valves: Rainbird PEB 1", 1 ½", 2" size

Boxes: Rectangular Boxes (standard)

Wire: Color coded wire per station

Spray Heads: Rainbird MP rotator (mp 1000's & mp 2000's ) Multi-stream (Low flow)  
Rainbird 1804 pop up's 4" (Regular flow)

Rotors: Rainbird 5000 (Smaller rotor areas) Rainbird I-20 (Larger rotor areas)

Drip: Rain bird XFS dripline w/ proper Rainbird fittings Rain drip filter kits (y-strainer & low flow valves)

Controller: Calsense Controller CS3000

Flow Meter: Calsense flow meter (various sizes)

Freeze Sensor; Hunter Freeze Click (or Calsense compatible option)

Wind Sensor: Calsense Wind Gage

Rain Sensor: Calsense RB -1 Tipping Rain Bucket

Flex Hose: ½" and ¾" Tigerflex

## Division 32 – Exterior Improvements

## **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,



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 nonmetallic 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 provided 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 1/2" 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.

### **Pipe Bedding**

Pipe bedding shall be as specified in Division 31 Earthwork.

### **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/>

#### 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/>

## Tarleton State University

### Site Lighting

#### **Pedestrian & General Area Lighting**

Luminaire: Kim Lighting Type 5 Post Top Mounted Shoebox 5SQ-168 Dark Bronze  
Lamp: High Pressure Sodium  
Pole: Kim Lighting PSA14-4125-FM-DB-P  
Color: Dark Bronze

#### **Antique Street Lamp and Pole**

Luminaire: King Luminaire K118 Washington  
Lamp: High Pressure Sodium  
Pole: King Luminaire KF77-10 Ductile Iron  
Color: Dark Antique Green

#### **Parking & Roadway Lighting**

Luminaire: Kim Lighting Type 5 Post Top Mounted Shoebox 5SQ-168 Dark Bronze  
Lamp: High Pressure Sodium  
Pole: 24 foot and Valmont DS210 Round Tapered 39 foot  
Color: Dark Bronze

## Prairie View A&M University

### Site Lighting

All exterior light fixtures shall be 277 volt and receive their power from an emergency generator.

## 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:

Valves: Ball Valves

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. Valves: Butterfly Valves

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.

Valves: Butterfly Valves

Fittings: ASTM A234 forged steel welding type, Class 300. Joints: AWS D1.1 welded.

### Heating Water Piping

2-1/2 inches and larger:

Steel Pipe: ASTM A53, Schedule 40, 0.375 inch wall for sizes 12 inch and over, black.

Valves: Butterfly or Ball Valves

2-1/2 inches and larger – in mechanical rooms and crawl spaces. Valves: Butterfly Valves

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.

Valves: Ball or Butterfly Valves

Fittings: ASTM A234 forged steel welding type, Class 300. Joints: AWS D1.1 welded.

2 inches and smaller:

Valves: Ball Valves

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:

Valves: Ball Valves

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 psig Maximun)**

Steel Pipe: ASTM A53, Schedule 80, black. Valves: Gate Valves

Fittings: ASTM B16.3 malleable iron Extra Heavy Joints: AWS D1.1 welded.

### **Low Pressure Steam Piping ( 15 psig Maximun)**

Steel Pipe: ASTM A53, Schedule 40, black. Valves: Gate Valves

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. Valves: Gate Valves

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. Valves: Gate Valves

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.

**GENERAL NOTE: ALL ELEVATED VALVES, ADD CHAIN OR SPINDLE DRIVE FOR SAFER OPERATION**